

# **INTERNAL EVALUATION IN MATHEMATICS FOR CLASSES VI-VIII**

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## INTRODUCTION

Internal or classroom evaluation is concerned with seeking evidence on the attainment of objectives of a course while the course is in progress. Its aim is to enhance the attainment of objectives by guiding teaching and learning.

Internal evaluation aids learning in many ways:

- It reactivates prerequisite knowledge prior to further learning especially important for hierarchical subjects.
- It clarifies the intended outcomes of learning and thus helps students in devising approaches to learning which are effective in their attainment.
- It provides another opportunity for active processing of the content which consolidates learning.
- It provides an opportunity for review, elaboration, and application of concepts and principles which enhances their learning and transfer.
- The feedback from internal evaluation helps in correcting errors in learning shortly after they occur and hence prevents them from being compounded with later learning.
- It motivates the students to be regular and keep up which is especially important for subjects like mathematics.
- Internal evaluation helps in teaching by demanding thinking about objectives, the match between objectives and instructional activities, the match between instructional activities and evaluation.
- The feedback from students enables the teacher to know where students are having difficulty, the kind of errors they make and thus help in taking remedial measures.

There has been little research in India on the effect of internal evaluation on student's learning and development of intellectual skills. Pritam Singh and Ved Prakash (1991) have suggested it as a priority area in research on examinations. The research evidence elsewhere to be discussed later suggests that it can be used effectively for enhancing learning by thoughtful planning and implementation. Teachers generally do not conduct it systematically and continuously and thus cannot use it for guiding teaching and learning. They generally do not have access to tools for internal evaluation other than textbook exercises. There is thus a need to discuss its importance, planning, conduct, and use for enhancing learning and provide access to tools for internal evaluation. In this monograph, we discuss that and present some tools for conducting internal evaluation in mathematics for classes VI-VIII.

A prerequisite for internal evaluation is the specification of the objectives of a course. The available resources do not state them clearly. These are specified in Chapter II. The objectives then need to be operationalized into questions for seeking evidence on their attainment. Writing of questions has generally been left to the intuitive wisdom of item writers at best with some guidance on how to write questions that do not confuse an examinee or provide clues to correct answers. In recent years, a technology of item writing has emerged to aid writing of items. We

give some suggestions which derive from and supplement these for the writing of questions in mathematics in Chapter III. Tools for internal evaluation are discussed and illustrated in Chapter IV, and tests seeking evidence on most of the objectives of the course for classes VI, VII, and VIII are given in Appendices I, II, and III respectively. Teachers can use these after ensuring that these measure understanding and not recall by ascertaining that examples and substantive language used in these are different from that used in class or text.

Planning, conduct, and use of internal evaluation for guiding teaching and learning are discussed in Chapter V.

The problems in the implementation of internal evaluation in the present setup are discussed in the concluding Chapter VI.

## CHAPTER II

### **SPECIFICATION OF INSTRUCTIONAL OBJECTIVES FOR MATHEMATICS AT UPPER PRIMARY STAGE**

A clear statement of objectives is a prerequisite for internal evaluation. The aims such as the development of critical thinking, learning how to learn, scientific attitude, preparation for a career found in reports of various commissions, committees, national policies on education, etc. provide a vision of what to strive for. But, these are too vague and ambiguous to offer any guidance for educational planning on a day-to-day basis or evaluation of students or educational programmes. These aims need to be translated into performance objectives with reference to specific content. The criteria for judgment of critical thinking or strategies for learning to learn may vary from field to field. Many taxonomies of educational objectives have been suggested for the classification of objectives (Landsheere, 1990; Singh, 1988, Bloom et. al., 1956). Among these, the taxonomy prepared by Bloom and associates has been most widely used. The general feeling is that Bloom's taxonomy is helpful in thinking about or analyzing objectives, but not so useful for formulating objectives. The problem with Bloom's taxonomy relate to the use of the same categories viz. knowledge, comprehension, application, analysis, synthesis and evaluation for all subjects, no guidelines for selection of objectives and difficulty in translating categories which are specified in terms of processes to questions for seeking evidence on those objectives. There is thus a need to specify objectives in terms of performance expected of students at the end of participation in a planned educational experience. Such objectives are known as instructional, performance, behavioural or educational objectives. A clear statement of such objectives besides helping in devising appropriate means for assessment and evaluation helps in communication among students, teachers and examiners and selection of appropriate learning strategies, teaching methods and organization of content. A vast literature is available on how to formulate objectives, there is a need to formulate objectives for different courses. However, one needs to guard against the numerosity of objectives which would be baffling to the users. It would be desirable to divide a course into parts which have similar objectives and specify content free objectives for each part. These may be operationalized for each topic using information, concepts, principles etc. related to the topic. Continuous emphasis on these objectives in classroom evaluation for different topics would enhance attainment of these, encourage appropriate learning strategies for these and help in learning of similar topics on one's own. The formulation of objectives besides the content and structure of the subject also needs to take into account the developmental level and prior experiences of students their ability level, their future needs, needs in daily life, preparation for more advanced courses, the requirement of careers in which they may engage, need to learn more on their own, and current professional views in a subject.

## Consideration in Specification of Objectives

At school level, the National Council of Educational Research and Training has prepared guidelines and syllabi for different stages of school mathematics and have written textbooks which incorporate these. Their syllabi and books are widely used all over India. However, some objectives are neglected in textbooks. Informal discussion with students

and teachers reveal that most of the teachers depend only on the textbook for teaching and only textbook exercises for evaluation. While objectives emphasized therein, especially higher level may not be emphasized in teaching and evaluation, those neglected therein are mostly neglected. There is thus a need to specify instructional objectives. It would help in planning teaching, learning and evaluation. In the ensuing section we suggest a framework for instructional objectives for different content areas included in the syllabi of classes VI-VIII prepared by National Council of Educational Research and Training (NCERT, 2005) considering the background of students, their future needs and professional views on mathematics education.

**Background-** According to NCERT syllabus (2005), the students at the end of primary stage should be able to have the following competencies in different areas in mathematics.

### **Number**

- Knows number sequence up to 1000.
- Counts in different ways starting from any number.
- Reads and writes three-digit numbers.
- Expands a number with respect to place values.
- Compare numbers.
- Finds place value in numbers beyond 1000.
- Forms greatest and smallest numbers given 2 or 3 specific digits.

### **Addition & Subtraction**

- Adds and subtracts numbers by writing them vertically without regrouping and with regrouping.
- Uses the place value in the standard algorithm of addition and subtraction.
- Solves addition and subtraction problems in different situations presented Through pictures and stories.
- Frames problems for addition and subtraction facts.
- Estimates the sum and difference between two given numbers.
- Adds and subtracts single digit numbers and two-digit numbers mentally.
- Adds and subtracts multiples of 10 and 100 mentally.
- Estimates sums and differences, and verifies using approximation.
- Appreciates the role of place value in addition and subtraction algorithms.

### **Multiplication**

- Writes multiplication facts.
- Writes tables up to  $10 \times 10$ .

- Multiplies two and three digit numbers using lattice algorithm and the standard (column) algorithm.
- Frames word problems.
- Estimates product of given numbers.
- Completes multiplication facts by adding partial products, mentally  
e.g.  $7 \times 6 = 5 \times 6 + 2 \times 6$
- Appreciates the role of place value in the multiplication algorithm.

### **Division**

- Divides a given number by another number in various ways such as by drawing dots, by grouping by using multiplication facts and by repeated subtraction.
- Explains the meaning of factors and multiples.
- Uses informal and standard division algorithms.
- Estimates quotients and verifies using approximation.
- Applies the four operations to life situations.

### **Geometry**

- Identifies and draws 2-D and 3-D shapes and describes their properties.
- Finds similarities and differences in properties of 2-D and 3-D shapes.
- Makes 2-D shapes by cutting other shapes and using tangram pieces.
- Tiles regions by using 2-D shapes and distinguishes between shapes that tile and do not tile.
- Makes 3-D shapes by using nets.
- Distinguishes between straight and curved lines.
- Gets the feel of an angle through paper folding and observation.
- Identify and draw acute, obtuse and right angles.
- Explores intuitively rotations and reflection of 2-D shapes.
- Explores intuitively symmetry in 3-D shapes.
- Has intuitive idea of a map and can reads simple maps (not necessarily scaled).

### **Money**

Applies the four operations to solving problems involving money and judges the correctness of answer by estimation.

### **Time**

- Reads time correctly on a hand clock.
- Expresses time using am and pm.
- Knows the number of days in a week, a month and a year.
- Justifies the need for a leap year.
- Reads a calendar to find a particular day and date.
- Can compute the number of days between two dates.
- Uses addition and subtraction in finding time intervals in simple cases.

### **Measurement**

- Relates commonly used larger and smaller units of length, weight and volume and converts one to the other.
- Measures lengths, weights and volumes by using a ruler, balance, and standard weights and containers marked with standard units.
- Compares weight by using a balance.



- Estimates lengths, distances and volumes.
- Determines perimeter of simple geometric figures
- Determines areas of simple geometric figures.
- Applies the four operations to solving problems involving length, weight and volume

### **Data Handling**

- Collects data through measurement or asking questions.
- Records data by tally marks.
- Represents data by pictograph and bar graphs.

### **Patterns**

- Identifies patterns in shapes, surroundings and numbers.
- Creates patterns with blocks, numbers, leaves, lines, geometrical shapes etc.
- Observes and extends patterns in sequence of shapes and numbers.
- Identifies geometrical patterns based on symmetry.
- Makes border strip and tiling patterns.
- Searches patterns in different ways of splitting a number.
- Identifies patterns in odd and even numbers and in adding odd and even numbers.
- Partitions a number in different ways.
- Identifies patterns in multiplication and division by 10 and 100.
- Identifies patterns in multiplication and division: multiples of 9
- Casts out nines from a given number to check if it is a multiple of 9
- Identifies patterns in square numbers and triangular numbers
- Relates sequence of odd numbers between consecutive square numbers.

However, tests given at the beginning of class VI (Mahajan, 1994, Institute of Advanced Studies, 1997) reveal that a majority of students have not acquired understanding of basic concepts and skills.

All India Annual Status Education Report (ASER) 2008 (<http://www.asercentre.org>) was conducted in 578 out of 583 districts in rural India by randomly selecting 30 villages per district using the PPS (Probability Proportional to Size Sampling) technique and the village directory of the 2001 census. Twenty households were selected in each village and all the children in the age-group 3-16 in the household were tested individually. In mathematics the student were asked to recognise numbers from 0-99, subtract two-digit numbers requiring renaming (that should have been mastered by class II), divide a three digit number by one-digit number (that should have been mastered by class IV). It revealed percentage of children in classes I-V who could perform these was as follows

Grade	Did not know anything	Recognise numbers 1-9	Recognise numbers 10-99	Subtract two-digit numbers	Divide a three digit number by one-digit number
I	34.6	65.4	22	4.4	1.3
II	12.6	87.4	52	16.7	3.9

III	5.6	94.4	73.1	38.7	10.8
IV	2.8	97.2	84.6	57.3	24
V	1.8	98.2	90.4	67.8	37

The children were also asked to tell time at 15-minute intervals and 5-minute intervals, the percentage of children in Grades I-V who could do these was as follows:

Grade	Could tell time on a clock at 5-minute and 15-minute intervals	Could compare money involving 2-4 five-rupee notes and 1-2 ten-rupee notes and could add 3 numbers involving 10, 50 and 100
I	7	21.4

II	17.5	42.6
III	32.9	61.9
IV	47.7	75.1
V	60.9	83.2

This makes further learning increasingly difficult which is reflected in low performance in topics requiring these as prerequisites and higher classes.

### **Stage of learning**

The research evidence suggests that most pupils at upper primary stage are at concrete operational stage and there is a need for concrete referents in mathematics which may be replaced by actions carried out in the mind on the basis of prior knowledge underlying concrete manipulations.

### **Future needs**

The upper primary stage is the terminal stage of compulsory education. We therefore need to develop skills useful for daily living. Therefore objectives relating to life skills such as communication, estimation, measurement, applications to problems in daily life and problem solving are emphasized.

### **Professional Views**

Besides the views expressed in NCERT publications, the professional views expressed in Curriculum and Evaluation Standards Published by National Council of Teachers of Mathematics, USA (NCTM, 1989) and endorsed by a large number of professional bodies were considered. We have tried to incorporate their suggestion that problem solving; building connections within mathematics, with

other subjects and real life; communication and mathematical reasoning should pervade the whole curriculum.

## Issues in Specifications of Objectives

The issues in the specification of objectives are their level of generality and setting of performance standards.

**Level of generality:** Generally three levels of generality may be distinguished and each is appropriate for a different purpose.

At a first and more abstract level are quite broad and general objectives which provide an overview toward which several years of education are aimed at e.g. objectives in guidelines for primary and upper primary grades (NCERT, 2005).

At the second level are objectives at which various taxonomies such as Bloom (1956), William and Haldyana (1982) were developed. The Central Board of secondary Education uses a simplified version of Bloom's taxonomy for setting papers for its examinations for secondary and senior secondary examinations. In these a two-way grid in which topics are listed along one dimension and processes: knowledge, understanding and application and from 2008 higher mental processes (check) are listed along the other dimension and weightage of different content areas and processes is specified. The objectives at level two are valuable for summative evaluation covering a number of units of a course and developmental objectives (Gronlund, 1985). Gronlund makes a distinction between **minimum essential objectives** for which near mastery may be aimed and **developmental objectives** such as communication, application, problem solving, mathematical reasoning, in which teaching is directed towards a general class of behaviors rather than the sample which is specifically tested and standards of performance are difficult to define.

At the third level is elaboration of level two objectives needed for designing teaching learning materials; the kind of detailed analysis undertaken for programmed instruction. These are valuable for internal evaluation of minimum essential objectives. We would specify objectives relating to knowledge, skills, understanding of concepts and procedures at level three and others requiring applications of these to a situation or problem solving at level two.

**Specification of Standards of Performance and Condition of Testing:** Mager (1962) in his influential book on preparing objectives for programmed instruction argued that (1) behaviour should be specified only in observable terms (2) standards of performance should be set in detail with a built in assumption of near mastery and (3) conditions under which performance is to be exhibited should be clearly identified.

We would specify the behaviour for minimum essential objectives and would like 80–90 percent of the children attain these. We also feel that multiple modes of assessment rather than a mode should be used. Teachers can select different modes depending on their use in teaching, available time and facilities.

**Content:** The specification of objectives for each topic would lead to too many

objectives and would be baffling to the teacher. It is better to group similar topics in a content area and specify content free objectives which can be used for all topics within the content area. We would adopt this strategy.

For specification of objectives, content has been classified into a system of numbers, fundamental and other operations on numbers, relations between numbers or variables to which they pertain, geometry, measurement, algebraic expressions, linear equations, data handling and graphs. Content free objectives are specified in these which are applicable to different content areas in these. Some lower level objectives requiring rote memory such as labeling of symbols, definitions, vocabulary are subsumed under higher level objectives. The computational complexity has also not been indicated. The levels suggested in NCERT curriculum (2005) may be used as guidelines for these.

## **Objectives in Different Content Areas**

The student should be able to do the following in a system of whole numbers, fractions, decimals, integers and rational numbers

### **Concept of a number**

- Represent a number in many ways such as concrete materials, pictures, number line, words, symbols, examples in the environment.
- Label its constituents e.g. places of digits in whole numbers or decimals, negative sign in integers or rational numbers and numerator and denominator in fractions and rational numbers.
- State properties of its constituents e.g. place value of different digits in a whole number or a decimal.
- Write numbers with specified properties e.g. all possible; smallest, largest using specified digits, successor or predecessor of whole numbers
- Compare numbers:
  - Compare two numbers by using  $>$ ,  $=$ , or  $<$ .
  - Write a number between two numbers.
  - Select a number from a set of numbers nearest to a specified number.
  - Arrange 3 or more numbers in ascending or descending order
- Write a number equivalent to a number expressed in a different manner or system e.g. a whole number or decimal given its expanded form or write a number in expanded form, a fraction or rational number in its simplest form, a fraction/rational number as a decimal and vice versa.
- Recognize pattern in a number series, extend it and state how it is formed and write its next terms and  $n^{\text{th}}$  term.
- Recognize the appropriate form of equivalent numbers in different situations e.g. when to use percentage, fraction, or decimal form
- Round off whole numbers to nearest ten, hundred, etc. and decimals to the nearest whole number, tenth, hundredth, etc.
- Recognize appropriate rounding off in situations in daily life.
- Estimate a specified number marked on a line segment whose end-points only are

given e.g. 180, on a line segment whose ends are marked 0 and 200 and  $\frac{3}{5}$  on a number line with endpoints 0 and 1.

- Recognize situations in which an underestimate or overestimate would be desirable
- Describe the need for numbers beyond whole numbers
- Recognize the inclusive relations between number systems and give counterexamples for ones that are not e.g. all whole numbers are integers, all rational numbers are not fractions e.g.  $-\frac{3}{4}$ .
- Estimate the number in large collections and describe the procedure used.

### **Fundamental Operations on Numbers**

- Carry out an operation using concrete materials, pictures, number line, or written or oral symbols or words.
- Translate from one mode to another
- Find number facts (addition and multiplication of one-digit numbers and their subtraction and division corollaries) in whole numbers using concrete materials, pictures, number line, counting, or number facts of related operations
- Acquire automaticity (answering without thought) in number facts in the whole numbers.
- Give steps in operations on different types of numbers and reasons for them.
- Execute operations on numbers of different complexity mentally, using paper and pencil or a calculator
- Use informal procedures.
- Recognize wrong procedures
- Use estimation to check the reasonableness of results.
- Use properties of operations such as associative or distributive properties of multiplication or relation between operations to verify computations e.g. minuend = subtrahend + difference, dividend = divisor  $\times$  quotient + remainder,  $769 \times 53 = 769 (50 + 3) = 769 \times 50 + 769 \times 3$ .
- Solve problems involving the use of an operation/ operations relating to transactions in real life by identifying-what is to be found out, extraneous or missing information, expressing mathematically what is to be found out in terms of mathematical operations and what is given; carrying out the necessary computations and checking the reasonableness of the answers by estimation, internal, or external checks.
- Recognize patterns in a series of numbers involving these operations.
- Formulate word problems requiring the use of operation/operations for given computations.

### **Properties of operations**

- Derive or illustrate properties that hold for different operations in a system of numbers.
- Fill in blanks involving specific properties.
- Recognize properties that hold or do not hold in different number systems and give a counterexample for properties that do not hold.
- Apply properties to reorganize computations so that they can be done more

efficiently.

- Identify similarities and differences in properties of number systems.

### **Factors and multiples**

- Define factors and multiples.
- Find whether a number is divisible by 2, 3, 5, 9, and 11 by using laws of divisibility.
- Find all factors of a number.
- Find the number given all its factors.
- Find all factors common to two numbers.
- Classify numbers as prime and composite.
- Express a number in prime factorization form.
- Verify or refute properties of divisibility by factors/ products of numbers.
- Find multiples of a number.
- Find the LCM of two or three numbers.
- Generalize procedure for finding LCM of two numbers which are co-prime or one is a multiple of the other.
- Judge reasonableness of answers to LCM by recognizing it cannot be smaller than any of the numbers.
- Recognize and solve new problems that call for finding LCM.
- Apply LCM to add and subtract fractions.
- Find HCF of two numbers.
- Generalize procedure for finding HCF of two numbers which are coprime or one is a multiple of the other.
- Judge the reasonableness of answers by recognizing HCF cannot be larger than the two numbers.
- Develop or use the relation the product of two numbers is equal to the product of their HCF and LCM to find one of these given the other three.
- Recognize and solve word problems that call for finding HCF.
- Use HCF for reducing a fraction to its simplest form.
- **Square roots and cube roots**
- Find the square roots/cube-roots of whole numbers that are perfect squares/cubes and positive rational numbers where numerator and denominator are perfect squares/cubes by factorization.
- Find the square root of a number using paper and pencil.
- Read square root, cube root of a number from a table or find these using a hand calculator.
- Judge reasonableness of answers by estimating these.
- Write these in exponential form and vice versa.
- Suggest applications of these.
- Recognize problems requiring these and solve them.
- Illustrate the following laws:
  - $\sqrt{ab} = \sqrt{a} \times \sqrt{b}$
  - $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

$$\sqrt[3]{ab} = \sqrt[3]{a} \times \sqrt[3]{b}$$

$$\sqrt[3]{\frac{a}{b}} = \frac{\sqrt[3]{a}}{\sqrt[3]{b}}$$

▪

## Exponents

- Express repeated multiplication of a number in exponent form.
- Express a number in exponent form as repeated multiplication of a number. ▪
- Illustrate the following laws, where a, may be a natural/integer/rational number and m and n are natural numbers.

$$a^m \times a^n = a^{m+n}$$

$$\frac{a^m}{a^n} = a^{m-n}$$

$$(a^m)^n = a^{mn}$$

- Express problems involving phenomenon in which increase/decrease is compounded at regular intervals in terms of exponents and solve those using tables or hand calculator.

## Relations between numbers/quantities

Ratio, proportion, and percentage

- Compare two numbers or two values of a variable by a ratio.
- Express a ratio in its simplest form.
- Divide a given quantity or amount in a specified ratio.
- Apply ratio to express and solve problems in daily life, mathematics, and other subjects.
- Identify two equal ratios as proportion.
- Recognize variables that are directly/inversely proportional.
- Find whether four numbers are in proportion.
- Given any three terms of a proportion  $a : b :: c : d$  find the fourth one
- Prepare tables involving several values of a variable that vary directly or inversely, and solve problems requiring the use of proportional values.
- Convert a fraction or decimal into a percent.
- Find k% of a natural number.
- Apply percentage to standard problems relating to transactions in daily life e.g. profit and loss, simple interest, growth/decline of a real-world phenomenon.
- Apply percentage to new problems e.g. commission, discount.

## Geometry

The student should be able to do the following to demonstrate an understanding of different types of concepts.

- **Undefined concepts:** point, line, plane
- Give examples from the environment that comes close to a point, line, or plane.
- Draw it on paper and name it.
- Distinguish it from more general concepts e.g. straight line from a curved line or concepts derived by imposing certain limitations on these e.g. a line from a ray or line segment, a plane from part of a plane.

- **Concepts defined in terms of basic concepts** e.g. angle, collinear points, point of the intersection of lines, point of concurrence, triangle, quadrilateral, and polygon.
- Identify its definition/drawing/model.
- Give examples from the environment
- Draw and name it.
- Identify examples obtained by varying a variable feature e.g. size, orientation and non-examples in which a critical feature is missing.
- Name it or its components in a geometrical figure.
- Measure it/its components
- Construct it given its measure or that of its components with the help of Geometrical instruments.
- Demonstrate its properties by drawing/measuring/cutting paper folding/making a model.
- Use these properties to find measures of some components given related components.
- Recognize constructions that are not possible on the basis of their properties.
- **Coordinate Concepts** e.g. different types of angles, triangles, quadrilaterals:
  - Identify/state its definition.
  - Draw/identify its figure.
  - Identify/make its model using concrete materials.
  - Identify/give examples from the environment.
  - Demonstrate its properties by drawing/measuring/cutting or paper folding.
  - Distinguish coordinate concepts.
  - Identify inclusive relations between them.
  - Derive other properties from its definition and knowledge acquired earlier.
- **The relation between concepts** e.g. parallel lines, linear pair of angles, congruent figures, a line of symmetry in a figure or between two figures:
  - Recognize relations between figures e.g. parallel lines, supplementary angles, congruent figures.
  - Draw figures having certain relations with a figure on a dot or a graph paper e.g. a line parallel to a given line, an angle to form a linear pair with a given angle, a figure congruent to a given figure e.g. a line, angle, triangle, square, rectangle, polygon parallelogram etc., a line which is an axis of symmetry of a figure or a figure so that a given line is the line of symmetry between two figures.
  - Explore conditions under which two figures/parts of a figure have a certain relation by measuring/paper folding/cutting/rotating about a point.
  - State the conditions under which two figures/parts of a figure have a certain relation.
  - Identify a relation between given figures and state conditions or properties used.
  - Express problems in terms of geometrical concepts and solve them.

### **Measurement**

The student should be able to

- Give examples from real life in which measurement of particular attributes is



needed.

- Measure attributes of figures or objects e.g. length, angle, area, volume with nonstandard units
- Describe the need for standard units.
- State metric units for measurement of different attributes.
- Convert units of measurement for an attribute from larger units to smaller units and vice versa in the metric system.
- Select appropriate units and tools for measurement of attributes of objects.
- Measure objects using appropriate units and tools to a specified accuracy.
- Find perimeter/area/volume for regular figures/objects by using formulae.
- Round off a measure to the desired accuracy.
- Compare figures/objects on an attribute.
- Estimate measurements of an attribute of an object.
- Recognize situations in which an underestimate or overestimate is preferable.
- Draw figures or make models that have specified measures of length/ dimensions, perimeter, area, volume.
- Draw figures with a specified relation of its measure with given figure/figures e.g. a line segment of a given length, sum, or difference of lengths of two given line segments, draw a line that bisects a line segment or an angle, a triangle or a square whose area is twice that of a given triangle or square.
- Verify the relations between such figures by measuring/ tracing them on paper and paper folding
- Find areas of figures which can be partitioned or partitioned and rearranged into one or more figures whose area can be determined using formulae.
- Apply it to problems in day-to-day life.
- Represent problems in terms of determination of perimeter, area, surface area and The volume of three-dimensional figures and solve them.

### **Algebraic expressions**

- Describe situations in which the use of literal numbers is valuable for representing a range of values of a variable e.g.  $n^{\text{th}}$  term of a series, formulae for perimeters or areas of figures.
- Express relations like four more or less than, three times or one-fifth of a given literal number  $a$ .
- Express operations on literal numbers in symbols e.g.  $a + b$ ,  $a - b$ ,  $a \times b$ ,  $a \div b$ .
- Express product of a number and literal numbers in simplest form.
- Identify terms as a product of a number and powers of a literal number.
- Find the  $n^{\text{th}}$  term in a number series.
- Distinguish like and unlike terms.
- Express a term as a sum or difference of like terms in many ways.
- Identify that for a combination of literal numbers and a number, or literal numbers or terms, commutative and associative laws of addition and multiplication and distribute law of multiplication over addition and subtraction hold.
- Fill in blanks involving laws
- Use the laws in operations on algebraic expressions.

- Give opposite of a given term.
- Find the values of a given term for specific values of literal numbers.
- Distinguish between monomials, binomials, and trinomials.
- Perform addition and subtractions on monomials, binomials, and trinomials.
- Simplify expressions involving brackets.
- Find all factors of a term.
- Find common factors of two/three terms in an algebraic expression.
- Rewrite the binomial or trinomial as a product with common factors as a factor.
- Multiply a binomial/trinomial with a monomial/binomial
- Reproduce identities involving special products.
- Apply identities for expanding or simplifying expressions.
- Apply identities for simplifying numerical computations.
- Express a rational expression in the simplest form by dividing the numerator and denominator by common factors.
- Divide polynomials by monomials, binomials, and polynomials by factorization.
- Express problems in terms of algebraic expressions and operations involving these and execute them.

### **Equations**

- Distinguish between identities and equations.
- Translate verbal statements into equations of the type:
- Solve equations of the type  $ax + b = m$  and  $\frac{ax + b}{cx + d} = n$ , where  $a, b, c$ , and  $d$  are integers and  $m, n$  are rational numbers.
- Verify the solution of equations by substituting the value of  $x$  in the equation.
- Express problems in daily life, measurement, geometry in one unknown, solve it and verify the solution.

### **Data Handling**

- Systematically collect, organize and describe data.
- Make appropriate inferences based on tables.
- Find the mean, mode, and median of ungrouped data.
- Summarize data in a frequency distribution.
- Interpret and construct a pictograph, bar graph, histogram, and pie chart.
- Define a random experiment, equally likely outcomes and event.
- List the outcomes of a random experiment e.g. throw of a coin, dice, drawing a ball of a certain colour from similar balls of different colours.
- Find the probability of an outcome or event (collection of outcomes) in random experiments.
- Recognize its application in daily life.

### **Graphs**

- Plot points on a graph.
- Read and draw linear graphs e.g. perimeter versus length of regular polygons, simple interest versus the number of years.
- Distinguish between linear and nonlinear graphs.

These objectives are not exhaustive, more may be added and some of these may be deleted depending on the ability and aptitude of the students and syllabus. The complexity of numbers, terms, and algebraic expressions have not been elaborated, we feel that for objectives requiring an understanding of concepts and procedures and higher-level objectives the complexity of these may be kept low.

A preliminary version of these objectives was given to 24 mathematics teachers in a workshop and some experts in NCERT. They were asked to appraise each objective

- in terms of its relevance to the NCERT syllabus and guidelines (revised since then)
- its expression in terms of students' performance.
- its communicability
- its level of generality
- its achievability in view of ability, aptitude, and available resources
- And to appraise all objectives in terms of completeness and, sufficiency to ensure understanding of basic concepts and procedures, development of skills in computation, estimation, drawing, and measurement; ability to apply mathematics in day-to-day life, and make some contribution towards developing the ability to communicate mathematics, mathematical reasoning and problem solving.

Modifications suggested by them were incorporated in an earlier version, which has been revised according to NCERT 2005 syllabus.

### III WRITING OF QUESTIONS

The objectives need to be operationalized into questions or tasks for getting evidence on their attainment. There is a need to get evidence on all objectives for formative evaluation and select or write questions that would provide evidence on their attainment.

#### Desirable Characteristics of Items

The items should have adequacy and consistency.

##### **Adequacy**

Adequacy is concerned with the use of the appropriate format and observing guidelines of writing good questions for different formats.

The considerations in the choice of format for an item are construction vs. selection of response and long vs. short answer which depend on the type of the objective. Knowledge and understanding of concepts and procedures can be assessed both by short answer questions which require the writing of response/filling in blanks or selection of response using true-false, matching, and multiple choice items. Both of these do not take much time and can be given in class.

Questions requiring construction of response in mathematics are more effective in enhancing learning, are fairly reliable over scorers, are easier to write, and have low printing costs.

Items requiring selection of response are valuable for distinguishing coordinate concepts given their definitions, drawings, concrete or real-life models, or numerical examples. Multiple choice or matching items may be used for these. These can be used for diagnosis of errors using distracters based on common errors, and in isolating abilities from general skills of writing spelling, and language usage. Scores on these do not vary over scorers. These are difficult to write; students may get the answer right by guessing and have high printing costs.

Objectives requiring application and integration of many concepts and procedures, synthesis of previous learning, original and innovative approaches of problem solving call for essay questions. These may be structured and divided into a number of parts e.g. in standard applications asking students what is given, what is to be found out, recognition of extraneous or missing information, selection of the correct method or operation on givens to determine the unknown, its execution to find the unknown and judge the reasonableness of answers using internal or external checks or for a complex operation asking students to explain steps or reasons for steps in a procedure. These are easy to score. Objectives requiring synthesis, divergent thinking, or original and innovative approaches to problem solving may be left open-ended. It is difficult to score these, but a class discussion of these would be valuable for enhancing learning. These should be tested under liberal time limits and may be given as homework.

Guidelines for writing different types of items are described in standard books on

educational measurement e.g., Gronlund, (1985), Popham, (1990), Thorndike and Hagen, (1977). These guidelines require that an objectively scored item should be unambiguous to the knowledgeable students and should not provide clues to the correct answer. Similarly, for constructed response items, the task should be clear and a scheme for its scoring planned.

### **Content Validity**

Question consistency is concerned with: is the question valid for getting evidence on the objective? In recent years a number of techniques of item writing have been suggested which specify the domain. If it completely maps the domain then the question of item objective congruence is resolved. If there is an element of subjectivity the judgments of subject matter experts may be used at the item level.

## **Techniques of Item Writing**

In recent years a number of techniques of item writing e.g. item forms (Hively, et.al. 1968, Osborn, 1968), sentence transformations (Bormuth 1970) use of examples and non-examples for testing of understanding of concepts, structural facet theory (Berk, 1978) and domain specification strategy (Popham, 1990) have been suggested for the writing of items. These provide explicit specific rules for generating items in the domain of the objective. These are discussed in detail in Roid and Haldyana (1982). These approaches differ in the degree of specificity, amount of discretion left to the item writer, and replicability of items generated. However, these are too sophisticated for the teacher. We suggest some simple techniques which derive from and supplement these and together can provide evidence on most of the objectives in mathematics.

- **Specializing**-Operationalize objective by using a special case e.g. substitute a specific number/numbers, measure/measures in a concept, drawing, law, a system of numbers, set of data that the child is familiar with. This is valuable for operationalization of objectives relating to conceptual understanding of numeration, algebraic terms, and expressions, execution of operations on numbers, reading of standard tables and standard application such as filling a cheque/deposit slip, checking entries in a bank statement/saving pass-book of a bank or post office, understanding of geometrical concepts, constructions, and measurement in geometry, classification, tabulation and graphical presentation of data and summarization of data.
- **Specializing with examples having specific characteristics:** For operationalization of some objectives e.g. order relations between numbers, simplifying computations using laws or special products, estimation of computational results; substitute examples having special characteristics e.g. for comparing numbers-use numbers based on common errors; for estimation of computational results using fundamental operations on the whole numbers-use numbers which are close to ten or its multiples; for simplification of computations using associative law -use numbers which after rearrangement sum to or have a product of 10 or its multiples; for simplification of computations using algebraic

identities-choose number which is close to multiples of ten or powers of ten e.g.  $49^2$ ,  $103 \times 97$ ,  $105^2$ .

- **Paraphrase objective in question form after substituting a special case/cases**-This is valuable for operationalization of objectives for recognition of laws that hold/do not hold, recognition of wrong procedures, recognitions of relations between numbers, concepts, comparing and contrasting concepts.
- **Direct use of the objective by a specification of concept, procedure, situation**-It is valuable for operationalization of objectives related to communication skills, giving reasons for steps in a procedure, estimation, synthesis of previous learning, divergent thinking e.g. describe the need for number beyond whole numbers; explain steps in an example of multiplication, describe how mathematics is useful to a farmer, give as many examples as you can of circular-objects in the environment, describe situations in which the use of literal numbers are valuable. These are difficult to score but a class discussion of these would be valuable for enhancing the attainment of such objectives.
- **Domain specification strategy** is valuable for the elaboration of objectives where examples cannot be generated mechanically e.g. applications of concepts and procedures to daily life, component skills in mathematical reasoning and problem solving. Popham (1990) suggested that the following details be specified for each objective.

**General description of the behaviour being assessed by the item.**

**Sample item that** reflects delimitation in stimulus and response attributes.

**Stimulus attributes**-A series of statements that delimit the class of stimulus material that will be encountered by the examinee.

**Response attributes**-A series of statements that delimit the class of response options or explicate standards by which an examinee's constructed-response would be judged.

**A specification supplement** to provide a more detailed listing or explanation of eligible content (optional)

Examples of elaboration of some objectives using domain specifications are given below:

1. **General description**-The pupil can recognize incorrect rules (new to him) by giving a counterexample.

**Sample Item**-If  $a$  and  $b$  are any whole numbers and  $a > b$ , then is  $-a > -b$ ?  
If no give a counterexample.

**Stimulus attributes**-The pupil would be given description of correct/incorrect rules and asked to identify them as correct or incorrect and give a counterexample for incorrect rules based on previously acquired knowledge.

**Response attributes**-A score of one for correct identification and an additional score of one for a correct counterexample in case of incorrect rules would be given.

2. **General description**-The pupil can apply a new operation in literal numbers to specific numbers.

**Sample Item**-If  $*$  is an operation such that  $a * b = (a + b)/2$  Then find  $3 * 4$ .

**Stimulus attributes**-The pupil may be given a new operation on literal number which results in familiar operations and asked to apply it to specific numbers from 1 to 5.

**Response Attributes**-Give a score of 1 for correct application of the rule.

3. **General description**-The pupil can generate stories in which computations requiring multiplications of decimal numbers are required.

**Sample Item**-Describe situations which require you to compute  $16.80 \times 0.5 = 8$ .

**Stimulus attributes**-Computation involving multiplication of a decimal number with another decimal number will be presented to generate a word problem.

**Response Attributes**-Judge response on whether it requires multiplication and reasonableness of numbers for the situation described. Give a score of one for the correct response to each of these.

4. **General description**-The pupil can recognise information is insufficient to solve a word problem.

**Sample Item**-The temperature at noon was below freezing point. In two hours it dropped by another 2 points. What was the temperature at 2 p.m.? If the information is not sufficient to solve the problem, state what additional information is required?

**Stimulus attributes**-pupil will be given word problems in which some information for solving the problem is missing. He will be asked if the information is not sufficient to solve the problem, state what information is missing.

**Response Attributes**-The pupil is expected to say the information is not sufficient to solve the problem and state what information is missing e.g. in the sample item how many degrees below zero was the temperature at noon.

5. **General description**-The student can identify the rule in forming a series of numbers and use it to give the next and  $n^{\text{th}}$  term of the series.

**Sample item**-Give the next and  $n^{\text{th}}$  term of the series 1, 4, 9, 16....

**Stimulus Attributes** the students will be given four terms of a series formed according to a rule and asked to write next term and  $n^{\text{th}}$  term of the series.

**Response Attributes**-A score of one for correct next term and a score of one for correct  $n^{\text{th}}$  term would be given.

6. **General description**-The pupil can formulate problems using given information.

**Sample item**-A lady went to buy vegetables at Mother's Dairy with Rs. 50. The rates of different vegetables were as follows:

Onions Rs. 18 per Kg.

Potatoes Rs. 16 per Kg.

Tomatoes Rs. 16 per Kg.

Cauliflower Rs. 8 per Kg.

Peas Rs. 25 per Kg.

Write a story problem using this data.

**Stimulus attributes**-The pupil will be provided some data which can give rise to a number of problems. He would be asked to write a problem using the data.

**Response attributes**-The response will be judged on how much information was used and sophistication of the questions asked. Scores 0-5

7. **General description**-The pupil can solve word problems involving linear equations with integral coefficients. Sample item-Rani has 15 rupees more than his brother. If the two together have 60 rupees. How much money Rani has?

(a) Write an equation using  $x$  for the money Rani has?

(b) solve it.

(c) verify the solution.

**Stimulus attributes**-Situations giving comparison of two dimensions, quantities, amount in terms of a ratio more or less and their sum will be presented and student asked to

(a) write an equation.

(b) solve it.

(c) verify results.

**Response attributes**-Give one point for writing the equation, one point for solving it correctly and one point for correct verification.

8. **General description** -The pupil can distinguish examples from nonexamples of a triangle.

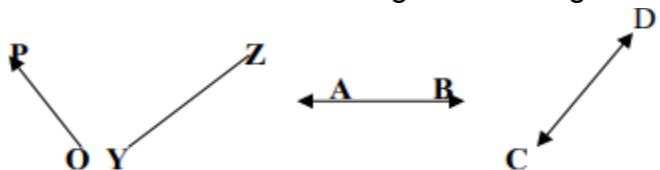
**Sample item**-Which of the following are triangles. Place a ✓ under them.

**Stimulus attributes** Two examples of triangles generated by varying the variable features e.g. size, orientation, shape and two non-examples which have a critical feature missing would be given and the student asked to recognize examples. The examples and non-examples different from those used in teaching would be used.

**Response attributes**-A correct identification of each example would be scored as one.

9. **General description:** The pupil can distinguish drawings of a concept from those of coordinate concepts.

**Sample Item**-Which of the following is a line segment, place a ✓ under it

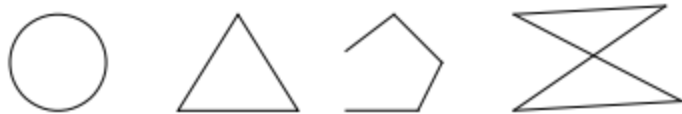


**Stimulus attribute**-The pupil would be asked to choose drawing of a concept from its drawing and that of coordinate concepts with different variable features e.g. orientations and sizes.

**Response attributes**-Choice of drawing of the concept would be marked correct.

10. **General description** Specify missing critical features of a concept.

**Sample Item** Which property prevents each of the following being called a quadrilateral, write it against them.



**Stimulus attributes** different drawings in which a critical feature of the concept is missing would be presented and student asked to state the feature that is



missing.

**Response attributes** correct identification of the feature. For example in the sample item, not composed of line segments, contains three rather than four line segments, is not closed and the line segments do not meet at endpoints would be marked correct.

## Utility and limitations of Techniques of Item Writing

These techniques are applicable and appropriate for different types of objectives. When applicable, their utility lies in providing a theoretical and rational basis for judging the content validity of items and relative ease with which items can be generated. The latter is especially valuable for developing criterion referenced tests and multiple forms of tests required in mastery learning.

A limitation of these techniques is that they are not applicable to heuristic problem solving procedures. A heuristic problem solving procedure is one which is based on general strategies rather than precise rules e.g. solving new problems rather than repeating a well practiced procedure as in standard applications.

**Writing Items for Problems Solving:** Problem solving is a process requiring use of previously acquired knowledge, skills and understanding to satisfy demands of an unfamiliar situation. The items for these besides involving synthesis of previous learning as in applications to real life, connections within mathematics and other subjects should have an element of novelty (for the student). It involves analysis of the problem to identify what is given, what is to be found out, extraneous or missing information, expressing what is to be found out in term of carrying out an arithmetic/algebraic operation, drawing/extension of a table, using what is given; execution of the operation; drawing/extension of the pattern by mathematical reasoning to solve the problem; judging reasonableness of answers using estimation, internal or external checks, suggesting extensions of the problem. In view of the numerosity of objectives and their combinations, it is very difficult to even give domain specifications. We would only give some guidelines for selecting problems and sources to locate them.

### Characteristics of a good problem

- It should involve mathematical concepts and procedures pupils are familiar with.
- It should lend itself to a variety of solutions.
- It should be possible to extend it in various ways.
- It should contribute to learning one or more strategies for understanding or solving problems such as guess a solution and check it, try a simpler version of the problem, make a table, draw a diagram, use a physical model, work backwards, look for a pattern, divide the problem into several parts and solve each, reason by analogy.

### Sources of problems

- First encounter with new learning for which students have the prerequisites e.g. after the pupil knows the sum of angles of a triangle, finding sum of angles of a quadrilateral, problems involving application of combination of operations after

they have experience with applications of each operation

- Textbooks, NCERT supplementary problem books and other books provide many problems involving many combinations of operations. Problems different from those discussed in class or examples in the book may be selected. Krulik and Rudnick (1987) have collected a number of problems on problem solving in mathematics suitable for classes I-XII.
- Journals: Mathematics Education for Children, and Mathematics Teacher published by National Council of Teachers of Mathematics U.S.A., suggest many problems which would be suitable for different grade levels. However, most teachers may not have access to these.
- Make a Question Bank in collaboration with other teachers in school.
- Use the following websites:  
<http://www.nrich.com>  
[http://www.koolkidstuff.com/frm\\_math.htm](http://www.koolkidstuff.com/frm_math.htm)  
<http://www.nap.edu>

## CHAPTER IV

### TOOLS FOR INTERNAL EVALUATION

The questions for getting evidence on different objectives need to be assembled into tools for administration. The assembly of questions into tools depends on the scope of the test focused vs. comprehensive; type of response-written, oral or demonstration using manipulatives and conditions of testing-speed versus power, with or without access to books, calculators, and other aids. Different combinations of these are suitable for different types of objectives and purposes of internal evaluation.

#### **Pretests**

Pretests are concerned with seeking evidence on the extent of mastery of prerequisite knowledge, concepts, and skills for a unit. These are valuable for ensuring mastery of prerequisites by remedial teaching if necessary. As the NCERT syllabus for upper primary grades assumes mastery of whole numbers, the concept of decimals, and fractions, pretests for these may be given before units requiring these as prerequisites either in class or as homework. These may need to be followed up by diagnostic tests. Some pretests for class VI and VII are given in Appendices I and II respectively that may be given before teaching topics for which these are prerequisites. Unit tests for earlier classes on other topics may also be given as prerequisites.

#### **Diagnostic Tests**

If the scores on a pretest are low in an area, there is a need to find out the source of difficulty.

For example in a test given to class VI in 3 government schools, it was observed that only 34%, 39%, and 45% were able to divide 750 by 23 correctly in a below average, an average, and a good school respectively (Mahajan, 1995). This calls for a test on prerequisites of division and easier skills in division to find out where to begin teaching of division e.g.

- subtraction facts
- concept of place value
- division facts
- division with one digit divisor and one digit quotient with a remainder
- division with one digit divisor, two or three digit dividend, two digit quotient with no remainder
- division with the one-digit divisor, two or three-digit dividend, two-digit quotient with a remainder
- division with the one-digit divisor, two or three-digit dividend, with two-digit quotient one of which is zero
- division with the two-digit divisor, one or two-digit quotient, all estimations yields correct results
- division with the two-digit divisor, one or two-digit quotient, some estimations yields under or overestimates

#### **Mastery Tests**

A large number of items referenced to an objective can be written. Techniques of item writing where applicable facilitate the writing of these. These should be given in class for objectives whose mastery is critical for further learning e.g. labeling of numerals, basic number facts-addition and multiplication of one-digit numbers and their subtraction and division corollaries, and understanding of basic concepts and procedures. For complex skills, items of different levels of complexity based on studies on the diagnosis of weaknesses may be written. It would be desirable to assure mastery of these for nearly all students. Unit tests on these for an earlier class can also be used as pretests. Sample tests for some objectives are given in Appendices I, II, and III for classes VI, VII, and VIII respectively.

### **Unit tests**

Unit tests are concerned with the extent of attainment of all the objectives of a unit. These besides knowledge and skills need to emphasize understanding of concepts and procedures and their connections with other topics within mathematics, other-subjects, and real-life to enhance understanding of concepts and procedures. A repeated emphasis on these would help in developing effective learning strategies for similar topics on one's own. Evidence on these may be obtained by written tests in class with or without access to books. Some items for unit tests for different topics are given in Appendices I, II, and III for classes VI, VII, and VIII respectively. Teachers may select items from these and supplement these with more items for unit tests.

Each unit should also contribute toward communication of mathematical ideas, synthesis of previous learning with it, mathematical reasoning, and problem solving. As the time for testing in class is limited and it is desirable to seek evidence on these under power conditions, it may be obtained by take-home tests.

Supplementary take-home tests are given with unit tests in Appendices I, II, and III for classes VI, VII, and VIII respectively.

These tests were given to 24 teachers and 3 resource persons for judging their content validity and adequacy. These were revised in light of their comments and suggestions. Since then these have been reorganized and some more items have been added to make them compatible with NCERT 2005 syllabus.

### **Individual tests**

For some objectives e.g. oral communication of mathematical ideas, demonstration skills involving manipulatives, estimation of computational results rather than actual computations, or where fluency is important as in number facts, individual tests are called for. These are also useful for the diagnosis of difficulties of individual students.

If these are not feasible some compromises may have to be made e.g. use of written instead of oral communication, timed test for number facts and estimation, take-home tests for demonstration skills for which manipulatives may be available at home.

### **Summative or Criterion Tests**

These are concerned with the assessment of objectives for the whole course and are generally used for grading purposes. These cover a much larger domain of objectives and hence can provide evidence only on a small sample of objectives. A

number of taxonomies have been developed to aid in the classification of objectives. The tests are then developed using two-way grids in which content is listed along one dimension and processes subsuming many objectives along the other. A number of items are written for each cell so as to have the desired weightage of content areas and different processes. A simplified version of Bloom's taxonomy which classifies objectives into knowledge, comprehension, application, analysis, synthesis, and evaluation has been extensively recommended and used in India. The central Board of Secondary Education uses a simplified version of Bloom's taxonomy restricting only to the first three categories viz. knowledge, understanding, and application, and specifies the weightage for different content areas and categories in its Class X and XII examinations. From 2008 they have added questions requiring higher-level thinking. Blueprints giving the weightage to different cognitive processes knowledge and skills, understanding, applications to day-to-day life, and higher-level thinking which require the application to new situations or problem solving, and content areas for classes VI, VII, and VIII are given in Appendices I, II, and III respectively.

**Knowledge**-involves recall or recognition of certain symbols, facts, laws, or procedures in the form they are generally taught or presented in the textbook.

**Skills**-involve behaviours that require facility in the application of a step by step procedure e.g. execution of four fundamental operations on numbers or algebraic expressions, drawing graphs, geometrical constructions, reading of tables.

**Understanding**-involves behaviours such as giving new examples of concepts distinguishing between coordinate concepts, translating from one mode of representation to another, making connections between various concepts and procedures within mathematics.

**Application to problems in daily life**-involves finding examples of concepts in the environment, applying mathematics to everyday situations by translating them into mathematical representations such as graphs, tables, diagrams, mathematical expressions and processing them, and interpreting the results.

**Higher-level thinking** involves an application to new situations or transfer or problem solving that in turn requires synthesis of previously learned concepts and procedures and mathematical reasoning to solve new problems.

The weightage given to different content areas and cognitive processes should be in accordance with time devoted and emphasis on those in teaching.

Sample Criterion tests for classes VI, VII, and VIII with content area weightage according to NCERT 2005 syllabus and cognitive processes are given in Tables I, II, and III respectively.

**TABLE 1**

### **BLUEPRINT OF CRITERION TEST FOR CLASS VI**

#### **Number of items on Different Cognitive Processes in Different Content Areas**

Content	Cognitive Process
---------	-------------------

	Knowledge and skills	Understanding	Application	Transfer	All
Number system	5	2	3	1	11
Ratio, Proportion and Unitary Method	2		1	1	4
Algebra	2		1	1	4
Geometry	3	5	3		11
Measurement	2			1	3
Data Handling	2				2
All	16	7	8	4	35

**TABLE 2**

**BLUEPRINT OF CRITERION TEST FOR CLASS VII**

**Number of items on Different Cognitive Processes in Different Content Areas**

Content	Cognitive Process				
	Knowledge and skills	Understanding	Application	Transfer	All
Number system	5	2	2	1	10
Ratio and Proportion	2		2		4
Algebra	2	2	1	1	6
Geometry	4	6	2		12

Data Handling	3	1			4
Measurement	1	1	1	1	4
All	17	12	8	3	40

**TABLE 3**

**BLUEPRINT OF CRITERION TEST FOR CLASS VIII**

**Number of items on Different Cognitive Processes in  
Different Content Areas**

Content	Cognitive Process				
	Knowledge and skills	Understanding	Application	Transfer	All
Number system	5	2	2	1	10
Percentage, Direct and Inverse Variation		1	4	1	6
Algebra	2	1	1		4
Geometry	1	6	1	1	9
Measurement	1	1	1	1	4
Data Handling	4	2			6
Graphs	1		2		3
All	14	13	11	4	42

These may be supplemented by take home tests involving synthesis of learning.

**Informal Evidence**

Teachers can also use other evidence for planning teaching such as observations of the class, response to oral questions addressed to the class, presentation of group reports on tasks assigned to groups, questions students ask, discussion with teachers in other subjects about the problems students have in applying mathematics to the subjects they teach.



## CHAPTER V

### PLANNING, CONDUCT, AND USE OF INTERNAL EVALUATION

#### Planning of Internal Evaluation

Crooks (1988) after a survey of studies on the effect of internal evaluation on learning concluded internal evaluation has powerful impacts on these which may be positive or negative. Internal evaluation thus needs to be thoughtfully planned and implemented.

The implication of research studies for the planning of internal evaluation are:

- It should seek evidence on facts and skills that are important for applications and further learning to consolidate learning of these.
- It should emphasize comprehension, understanding of concepts and principles and application to problems, to enhance the transfer of these to the solution of new problems and encouragement of deep learning approaches.
- It should continuously emphasize important objectives common to many topics in a content area for shaping learning of such topics.
- It should use short rather than multiple choice questions as those are likely to be more effective for enhancing learning.
- It should be conducted as frequently as possible.
- The feedback on it should be provided after a task is completed and should focus attention on progress in mastering the task.

The other issues in the planning of internal evaluation are its scope, weightage of different objectives, selection of assessment techniques, their administration to obtain students responses, scoring, recording, and analysis of data, nature, and timing of the feedback to the student and recording of feedback of the group for guiding teaching and curriculum evaluation. We give some suggestions for these based on scholarly writings and research.

**Scope** It is desirable to get some evidence on all objectives, the more extensive the better.

#### **Weightage of Different Objectives**

It may be noted that higher-level objectives subsume many lower-level objectives. Research evidence suggests that factual and computational questions facilitate the attainment of objectives requiring these only, whereas higher-level questions not only enhance the attainment of objectives calling for those but also have a facilitative effect on the attainment of lower-level objectives.

The extent of evidence on different objectives would depend on their complexity and breadth, time, and emphasis given to it in teaching. The objectives high on these should be given a higher weightage.

How much evidence to secure on each objective would also depend on other practical constraints such as the time that can be devoted to testing and scoring by

the teacher?

### **Selection of Techniques of assessment**

It is desirable to use multiple techniques for evaluation-written tests given as take-home or in-class, tests requiring the use of manipulatives, class presentation of essays, or group project reports. As many techniques as feasible or the most appropriate technique should be used for the evaluation of an objective. However, in practice, there are many constraints such as large classes, heavy teaching load, lack of manipulatives, and time that can be devoted to testing; some compromises may have to be made. It is expedient to use written in-class objective tests for understanding of concepts and procedures and skills of low computational complexity. Research evidence suggests that questions requiring students to construct an answer are more effective in enhancing learning than those requiring selection of a correct response as in true-false, multiple choice, and matching questions. Take-home tests may be used for the execution of complex procedures, application of many concepts and procedures to a situation in daily life, solving a novel problem, or those requiring divergent thinking. Research evidence suggests that a question should not be too difficult and answer should be provided only after the student has responded to it. Thus answers for take-home tests should be made available only after the students have tried them. If individual tests are not possible for objectives such as automaticity of number facts and speed in fundamental operations, use of estimation rather than actual computation, separate timed tests may be used for these. Evidence on objectives related to oral communication or demonstration by manipulatives may be procured on a sample basis giving an opportunity to all students on different occasions.

Informal evidence such as teachers' observations on interest or involvement of students, perseverance, answering, and asking of questions may also be recorded and used by the teacher for guiding teaching and learning.

### **Timing of Tests**

It would depend on the purpose of the test.

A **Pretest** concerned with ascertaining knowledge of prerequisite concepts and skills should be given at the beginning of the unit.

A **mastery test** should be for an objective after providing instruction and sufficient practice on it. A unit test should be given after completing instruction on the unit to monitor progress on objectives of the unit.

A **summative or criterion test** should be given at the end of the course to evaluate students and the effectiveness of the course. Pretests and mastery tests may be given as take-home for some objectives and in-class for others and unit and criterion or summative tests may be given partly as in-class and partly as a take-home test.

## **Conduct of Internal Evaluation**

The students may be asked to respond to such tests and may also be entrusted to do scoring of some tests such as pretests, mastery tests, items in unit tests that can

be scored objectively, and record-keeping of all tests.

Tests for higher-level objectives would need to be scored by the teacher and a record of class performance on those may be kept along with other informal evidence by the teacher.

It would be desirable to find and record the average score for an item for items in which partial credit was given and proportion of students answering the item correctly for items scored correct or incorrect only and the frequency of different kinds of errors. If it is not feasible the students may be asked to raise hands that got the item correct, and their number noted against the item for dichotomously scored items, and the teacher may note the question many students could not answer and on tests scored by the teacher after scoring the tests.

## **Uses of Internal Evaluation**

The internal evaluation may be used to guide learning, teaching, modification of the syllabus, and grading.

### **Learning**

The tests help the students to know what is important and learn it. The feedback from the test enables the students to know what he/she has learned or not learned. The student can then learn it on his/her own from books, other teaching-learning materials, or discussing it with teachers or classmates or someone at home.

The teacher can look at individual records and guide the student on what he/she needs to learn and how to go about it.

Research evidence suggests that answering questions and feedback regarding the performance enhances learning provided the questions are not too difficult and it is effective only if it is available after the students' response. The feedback should be given immediately if possible. In any case, it should not be postponed so long that it ceases to be relevant and students are not motivated to learn from it.

The form of feedback that would be effective depends on the nature of the task and the correctness of the answer. If the answer is correct simple confirmation is enough, giving the correct answer for incorrect factual questions is enough. More detailed feedback may be desirable for questions relating to higher-level objectives. Students who answer such items with high confidence may be helped to identify their erroneous thinking, whereas students who answered it with low confidence may need to be given conceptual help and advised to restudy. The teacher should focus attention on students' mastery of the task. Such emphasis on personal progress enhances self-efficacy, encourages effort attribution, and reduces attention to social comparisons. If individual feedback is not possible the teacher should correct the common misconceptions and teach again the concepts or procedures most students had difficulty using alternative strategies and study materials.

### **Teaching**

The feedback from a pretest is helpful in identifying prerequisite concepts and skills on which students do not have adequate mastery. Some of these need to be

followed by detailed diagnostic tests to find out what the students know and where to begin teaching on the hierarchy of the skill. This would facilitate planning and effectiveness of remedial teaching for those weaknesses and in turn, enhance the learning of the units for which these are prerequisites.

The feedback from a mastery test provides an indication of the extent of mastery on the concept or skill. If that is low, it needs to be taught again preferably using an alternative approach or providing more practice on it. This is necessary for further learning for which it is a prerequisite. For example in a study by Nanda (1970) low p values (.06, .09, .13, .09, 0, .06) of items requiring addition or subtraction of algebraic expressions can be traced back to lack of mastery of addition and subtraction of integers (p values of 4 items on these were (.13, .08, .29, .32) and concept of like terms (p values of 5 items requiring a distinction between like and unlike term were (.57, .66, .66, .14, .41) The feedback from unit tests and summative tests provides an indication of retention of minimum essentials and attainment of higher level and developmental objectives like understanding of concepts and procedures, communication, building connections within mathematics and real-life, mathematical reasoning, problem solving. If these are low, these suggest a need to improve the attainment of these by thinking of the possible causes and taking corrective measures

### **Modification of the Syllabus**

The low attainment of some objectives calls for rethinking about the curriculum. Is the objective important enough to devote more time to it? There is a trade-off between mastery of a few objectives of key import and low-level learning of many objectives. For example p-value of items on tests of divisibility by 4, 5, 8, 6, 9, 11 given to about 100 students in three schools were .35, .37, .35, .06, .02, .22 respectively (Mahajan, 1995). Most of the students who got it correct had not used tests of divisibility but divided by the number to check it. In view of current thinking on restricting mastery of fundamental operations on fractions to fractions of low complexity, it would be better to restrict tests of divisibility to 2, 3, and 5 only and devote the time saved to develop mathematical reasoning.

It may also call for looking at its appropriateness considering the developmental level of the students. The tests given to students in Algebra in classes VI and VII in several government schools (Nanda and Brared, 1972) indicated very low levels of achievement. Should it be postponed in view of this to higher classes? If not, what prior experiences should be provided to enhance its learning.

### **Grading**

The use of internal evaluation is generally not recommended for grading. But, as students by class VI are attuned to working for marks, unit tests may be assigned a certain weightage along with summative tests. For decisions about borderline cases other evidence from students' records may also be used.

## CHAPTER VI

### IMPLEMENTATION OF INTERNAL EVALUATION

While access to tools for the internal evaluation would facilitate the implementation of internal evaluation to enhance learning, there are many other problems in its implementation that require the attention of authorities viz. principals of schools, directorates of education, and examination boards.

Teaching and learning in India are in general guided by the demands of external examinations. These mainly emphasize the reproduction of information, computational skills, and standard applications; only in 2008, some questions on higher-level objectives have been included. As these have prime importance for admission to higher-level courses and employment, most students aim at getting good marks in those rather than attainment of higher-level objectives. There is thus a need to emphasize to encourage their teaching and learning. There is some evidence to show that it can be accomplished just by a change in examinations. Fredericksen (1984) provides an example to show how only changes in evaluation changed the behaviour of students and teachers in a gunnery mate school in Bainbridge in Maryland. He had gone there for a project on the selection of candidates for the school. They found that grades in that school were predicted best by verbal and reading comprehension tests which were surprising considering the job they would be expected to do. In this school lecture-demonstration method of teaching was used. The students studied the technical manuals and examinations were based on technical manuals and lectures. These examinations were replaced by performance tests. In the beginning, only a few students could perform the task even with liberal time limits. But the new students, who got the word of what the tests were like, began practicing assembly and disassembly of guns. Performance on tests improved with each class. The teachers also got the point and started teaching these. Soon most of the students were able to do well on tests. The validity coefficients also changed. The verbal and reading test validity dropped and mechanical aptitude and mechanical knowledge tests became the best bets for predicting grades in gunnery mate school.

Newble and Jaeger (1983) found that in a medical school when ward ratings were replaced by an oral clinical examination, students started spending more time in the library for preparation of their written examinations and less time in wards. This was due to the fact that students found that ward ratings were almost always above the pass level, whereas there were failures in written examinations. Instituting a different clinical examination shifted the balance back. Newble and Jaeger commented that the effect of the change was so great as to indicate that examinations are perhaps the major factor influencing learning in a medical school. A number of similar examples are given by Milton (1982) in a book that critically analyzes college evaluation practices. As the students and teachers are more examination oriented, the opportunity to employ these as a springboard for qualitative improvement of education should be grasped. Boosting quality by the improvement of examinations would be more cost-effective than other methods for

improving the quality of education e.g. augmenting the caliber of teachers or textbooks.

The internal evaluation which can be used for enhancing deep learning needs to be given importance by using it for grading purposes also. Although most scholars subscribe to the view that the primary function of internal evaluation should be guiding teaching and learning and it should not be used for grading. But, experience shows unless it counts toward a grade, students generally do not pay much attention to it. They may not show up for tests, hand-in assignments, etc. Also, many important objectives of a course cannot be assessed by one time, closed book, limited time examinations. It would be desirable to assess those internally. The scoring of these and comparability of scores marked by different examiners may pose problems that need to be resolved. However, there is no justification for normative grading, as there is sufficient evidence to indicate that it provides undesirable consequences for most students. Crook (1988) lists the following among them, reduction in intrinsic motivation, debilitating evaluation anxiety, ability attribution for success and failure that undermine student effort, lowered self-efficacy for learning in weaker students, and reduced use and effectiveness of feedback to improve learning.

Internal evaluation involves continuous work on the part of the teachers which many may not be willing to do. They may be provided incentives to do that. Oral questions can be used for internal evaluation which would not involve much work on the part of teacher for scoring. But, as Brophy and Good (1970) on the basis of observation of teachers and students in the classroom, noted that teachers quite unconsciously direct their teaching and explanations to some students and ignore others. Give positive reinforcement and encouragement to some students but not to others and encourage active participation from some students and discourage it from others. Typically the students in the top fourth or third of the class are given the greatest attention and encouragement by teachers, while the students in the bottom half of the classes are given the least attention and support. It would be better to provide teachers with question banks or tools for internal evaluation and reduce teaching load.

Additional resources would also need to be raised for typing and duplication of quizzes, unit tests, etc. The schools can provide it or alternatively, these can be printed as booklets and students can be asked to buy them.

There may be problems with the time needed for internal evaluation. The number of working days in the schools may be increased to provide it.

To conclude successful implementation of internal evaluation to enhance deep learning would require

1. convincing teachers and students about the value of internal evaluation for ensuring mastery of prerequisites, for further and higher learning, and guiding teaching and learning.
2. providing motivation for higher learning by changing the emphasis in examinations on it.
3. providing reliable and valid tools for evaluation and other facilities.
4. finding additional resources for evaluation.

5. giving importance to it for the award of a degree or grades and selection for jobs or higher education.

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## **APPENDIX I - TESTS FOR CLASS VI**

### **Pretest 1: Numeration, Notation, and Concept of Place Value**

1. Write the following numbers in words:
  - (a) 189
  - (b) 7059
  - (c) 4008
  - (d) 54,679
  - (e) 7,00,005
2. Write the following numbers in figures:
  - (a) Seven hundred six
  - (b) Five thousand three hundred eight
  - (c) Ninety three thousand fifty three
  - (d) Six lakh seventy-two thousand
  - (e) Eight lakh seventeen
3. Write the successors of
  - (a) 56
  - (b) 39
  - (c) 129
  - (d) 9999
4. Write the predecessor of
  - (a) 67
  - (b) 50
  - (c) 100
  - (d) 1000
5. Compare the following pair of numbers by writing  $>$ ,  $=$  or  $<$  in the space between numbers.
  - (a) 56 \_\_\_ 65
  - (b) 43 \_\_\_ 403
  - (c) 783 \_\_\_ 806

6. Find the number that is nearest to 100 in the following numbers and encircle it.  
98, 103, 99, 100
7. For the number 435, give the place value of  
(a) 4  
(b) 3  
(c) 5
8. For the number 602, give the digit in  
(a) hundreds place  
(b) units place  
(c) tens place
9. Write the largest number with digits 2, 6, 0 using each digit once only.
10. Write the smallest number with digits 8, 1, 4, using each digit only once.

## Pretest 2: Fundamental Operations on Whole Numbers

1. Give a Mastery Test on Multiplication and Division Facts

2. Simplify

$$\begin{array}{r} (a) \ 6 \\ \ 8 \\ \hline + 3 \end{array}$$

$$\begin{array}{r} (b) \ 37 \\ \ + 80 \\ \hline \end{array}$$

$$\begin{array}{r} (c) \ 425 \\ \ +488 \\ \hline \end{array}$$

$$\begin{array}{r} (d) \ 16 \\ \ 170 \\ \hline +432 \end{array}$$

$$\begin{array}{r} (a) \ 352 \\ \ - 187 \\ \hline \end{array}$$

$$\begin{array}{r} (b) \ 503 \\ \ - 49 \\ \hline \end{array}$$

$$\begin{array}{r} (c) \ 800 \\ \ - 426 \\ \hline \end{array}$$

$$\begin{array}{r} (d) \ 300 \\ \ - \ 4 \\ \hline \end{array}$$

$$\begin{array}{r} 3. \ (a) \ 172 \\ \ \times 23 \\ \hline \end{array}$$

$$\begin{array}{r} (b) \ 382 \\ \ \times 50 \\ \hline \end{array}$$

$$\begin{array}{r} (c) \ 523 \\ \ \times 807 \\ \hline \end{array}$$

$$\begin{array}{r} (d) \ 475 \\ \ \times 600 \\ \hline \end{array}$$

$$(a) \ 37 \div 5$$

$$(b) \ 350 \div 5$$

$$(c) \ 236 \div 7$$

$$(d) \ 529 \div 5$$

4. (a)  $5 \times 30$       (b)  $30 \times 40$       (c)  $40 \times 80$       (d)  $179 \times 0$

5. Check the answer to subtraction  $732 - 258 = 47$  by using addition.

6. Check the answer to the division of numbers given in Q.5 by using the relation between dividend; divisor, quotient, and remainder.

7. Rajan bought 2 kg. mangoes at the rate of Rs. 12 per kg. If he gave a fifty rupee note to the shopkeeper, how much money he would get back

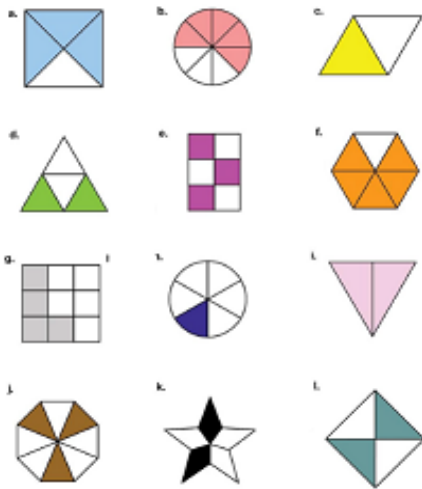
8. Vivek bought 4 notebooks at the rate of Rs. 3 per notebook and a book costing Rs.15. How much money he would have to pay to the shopkeeper.

9. If the area of a rectangular field is 72 square metres. If its length is 9 metres, what would be its width?

10. Rajdhani starts from New Delhi Railway station at 4 o'clock in the evening. It reaches Mumbai at 9 O'clock in the morning the next day. How much time does it take for the journey from New Delhi to Mumbai?
11. Find the cost of fencing a square field whose side is 40 metres at the rate of Rs.5 per metre.
12. Describe a situation in daily life for which the following computations would be required:
  - (a)  $53 + 60 + 42 + 67 = 222$
  - (b)  $100 - 33 = 67$
  - (c)  $7 \times 6 = 42$
  - (d)  $18 \div 3 = 6$
  - (e)  $30 - (12 + 10) = 8$

## Pretest 3-Concept of Fractions

1.What fraction of each shape is shaded?



2.In the fraction chart given below what fraction is represented by the following:



- (a) 2 orange strips
- (b) 3 red strips
- (c) 5 red strips
- (d) 1 orange strip
- (e) 1 yellow strip
- (f) 2 blue strips



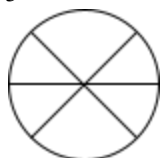
3. Your mother wants to give you three-fourth of a cake.

(a) In how many equal pieces should she cut it first?

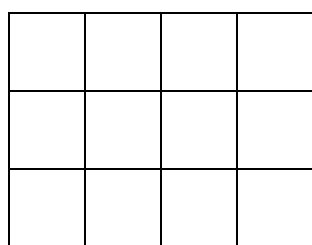
(b) How many of those pieces should she give you?

4. Shade

(a)  $\frac{1}{3}$  of the circle



(b)  $\frac{3}{4}$  of the rectangle



(c) two-third of the set of stars



4 In how many rows or columns would you arrange 40 counters to find one-eighth of the collection?

5 Arrange 24 counters in an array with 6 rows and find the number of counters in



(a) one-sixth of the collection



(b) three-sixth of the collection



(c) five-sixth of the collection



6 (a) How many triangles  would cover  completely?



(b) The triangle  is what fraction of the rhombus  ?



(c) How many triangles  would cover  completely?

(d) This triangle  is what fraction of  ?

(e) How many triangles  would cover  completely?

(f) This triangle  is what fraction of  ?

(g) How many  would cover  completely?

(h) This trapezium  is what fraction of  ?

7 Use the fraction chart given in Question 2, to find fractions that are equivalent to the following fractions:

(a)  $\frac{1}{2}$  (b)  $\frac{1}{3}$  (c)  $\frac{2}{8}$  (d)  $\frac{4}{6}$

8 Draw the number lines and label the end-points as 0 and 1 and divide them into equal parts to show the following fractions:

(a)  $\frac{1}{2}$  (b)  $\frac{2}{5}$  (c)  $\frac{5}{7}$  (d)  $\frac{7}{8}$

9 Find the following (you may use counters or drawings of counters):

$\frac{1}{4}$  of 12       $\frac{2}{3}$  of 9       $\frac{7}{10}$  of 40

(a) (b) (c)

10 Write a fraction that is equivalent to the following fractions:

$\frac{1}{2}$        $\frac{3}{4}$        $\frac{2}{3}$

(a) (b) (c)

11 Compare the following fractions by writing  $>$ ,  $<$ , or  $=$  between fractions.

$\frac{2}{6}$    $\frac{5}{6}$        $\frac{2}{3}$    $\frac{3}{4}$        $\frac{3}{4}$    $\frac{5}{6}$        $\frac{2}{3}$    $\frac{4}{6}$

(a) (b) (c) (d)

12 Arrange the following fractions in ascending order:

(a)  $\frac{2}{8}$ ,  $\frac{7}{8}$ ,  $\frac{4}{8}$       (b)  $\frac{1}{4}$ ,  $\frac{1}{8}$ ,  $\frac{1}{7}$       (c)  $\frac{1}{5}$ ,  $\frac{1}{6}$ ,  $\frac{1}{2}$

(a) (b) (c)

- 13 Arrange the following fractions in descending order

$\frac{3}{6}, \frac{3}{7}, \frac{3}{4}$

$\frac{2}{3}, \frac{2}{8}, \frac{2}{5}$

$\frac{4}{15}, \frac{3}{5}, \frac{2}{3}$

(a)

(b)

(c)

- 14 Use fraction chart to encircle the fraction closest to

(a)  $1 - \frac{2}{3}, \frac{3}{4}, \frac{7}{8}, \frac{8}{9}$

(b)  $\frac{1}{2} - \frac{2}{3}, \frac{2}{5}, \frac{5}{7}, \frac{3}{4}$

- 15 Write 3 fractions equivalent to fractions given below:

(a)  $\frac{1}{2}$

(b)  $\frac{2}{5}$

(c)  $\frac{2}{3}$

- 16 Write 3 mixed numbers.

- 17 Convert the following improper fractions into mixed numbers

$\frac{10}{8}$

$\frac{5}{3}$

(a)

(b)

- 18 Convert the following mixed numbers into improper fractions

$1\frac{6}{7}$

$3\frac{3}{4}$

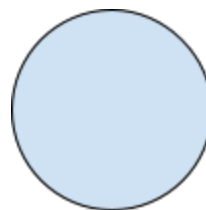
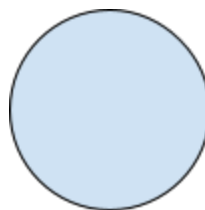
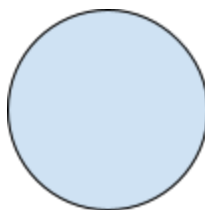
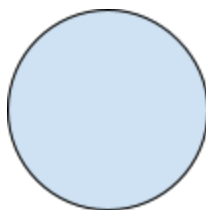
(a)

(b)

- 19 Divide the following into 2 equal parts, shade one part, and write it as an improper fraction as well as a mixed number.



- 20 Divide the following into 3 equal parts, shade one part, and write it as an improper fraction as well as a mixed number



## Unit Test 1-Whole Numbers

1. Write the following in words in the Indian numeration system:
  - (a) 569
  - (b) 408
  - (c) 2,509
  - (d) 7,003
  - (e) 83,076
2. Write the following in figures:
  - (a) five hundred forty-four
  - (b) seventy thousand forty-nine
  - (c) five lakh seven hundred and thirteen
3. (a) Write the predecessor of 4000.  
(b) Write the successor of 99999.
4. Write the largest number with digits 2, 3, 5, 7 using each digit only once.
5. I am a 6 digit number. My  
3 is worth 3,00,000  
5 is worth 50,000  
4 is worth 40  
8 is worth 8  
6 is worth 600  
my other digit is worth 7  
Write the number.
6. In 6,45,342, how much larger is the 4 with a larger place value compared to 4 with a smaller place value
7. Round 3472 to
  - (a) nearest 10
  - (b) nearest 100
  - (c) nearest 1000
8. A number has been rounded to the nearest 10 as 70. What is the possible range for the original number?
9. Simplify
  - (a)  $8000 - 246$
  - (b)  $748 \times 304$
  - (c)  $578 \div 45$
  - (d)  $750 \div 37$

10. Fill in blanks
  - (a)  $15 - \underline{\hspace{1cm}} = 6$
  - (b)  $7 \times \underline{\hspace{1cm}} = 56$
  - (c)  $\underline{\hspace{1cm}} \div 6 = 9$
11. Estimate the following
  - (a)  $480 \times 512$
  - (b)  $822 \div 38$
12. Fill in blanks
  - (a)  $734 \times 861 = 861 \times \underline{\hspace{1cm}}$
  - (b)  $860 + (40 + 135) = (860 + \underline{\hspace{1cm}}) + 135$
  - (c)  $218 \times (7 + 4) = 218 \times 7 + \underline{\hspace{1cm}} \times 4$
  - (d)  $345 + 345 + 345 = \underline{\hspace{1cm}} \times 345$
13. How do whole numbers and natural numbers differ?
14. Is any natural number a whole number? If not, give a counterexample.
15. Is any whole number a natural number? If not, give a counterexample.
16. If a and b are any whole numbers.  
Then put a  $\checkmark$  against statements that are true for all values of a and b and an X against ones which are not true for all values of a and b and give a specific example that contradicts it
  - (a)  $a - b$  is always a whole number
  - (b)  $a + b = b + a$
  - (c)  $a \div b = b \div a$
  - (d)  $a + 0 = a$
17. Simplify the following using distributive property of multiplication:
  - (a)  $345 \times 16 + 345 \times 4$
  - (b)  $456 \times 169 - 456 \times 69$
18. Use an easier way to simplify the computations given below by using properties of operations on whole numbers.
  - (a)  $(197 + 78) + 3$
  - (b)  $(88 \times 5) \times 2$
19. Describe situations in daily life that would require the following computations.
  - (a)  $17 + 8 + 5 = 30$
  - (b)  $20 - 11 = 9$

- (c)  $7 \times 6 = 42$   
 (d)  $12 \div 3 = 4$
20. If two odd numbers are added, would the sum be an odd number? If not, give a counterexample.
21. If two even numbers are multiplied would the product be, always even? If not, give a counterexample.
22. Write the next term of the series  
 (a) 3, 6, 10, 15, \_\_\_\_  
 (b) 1, 4, 9, 16, \_\_\_\_
23. The numbers given below have been written by a rule. Find the rule and complete the following using the same rule.  
 (a)  $24 =$                       (b)  $37 =$                       (c)  $78 =$
- $11 \rightarrow 2$   
 $14 \rightarrow 5$   
 $29 \rightarrow 11 \rightarrow 2$   
 $77 \rightarrow 14 \rightarrow 5$
24. Find the product of pairs of numbers given below:  
 (i)  $5 \times 5$                       (ii)  $3 \times 3$                       (iii)  $6 \times 6$                       (iv)  $8 \times 8$   
       $4 \times 6$                              $2 \times 4$                              $5 \times 7$                              $7 \times 9$
- Do you see a pattern? If yes, use the above pattern to find  $36 \times 38$  without actual computation given  $37 \times 37 = 1369$ .
25. Write the decimal number for XLII
26. Write 92 as a Roman numeral
27. A factory has an order of 500 shirts. if it can make 45 shirts every day, how many days would it take to fulfill the order? What did you do with the remainder and why?
28. If a notebook costs Rs. 3, how many notebooks can you buy, if you have 10 rupees? What did you do with the remainder and why?
29. Mentally estimate the quotient and state whether it will be an underestimate or overestimate?  
 (a)  $47 \div 20$   
 (b)  $213 \div 39$   
 (c)  $172 \div 20$
30. Insert parentheses to make the following equations true.  
 (a)  $2 + 3 \times 4 = 20$   
 (b)  $4 \times 5 - 2 = 12$

- (c)  $5 \times 4 - 2 = 10$   
 (d)  $36 \div 6 - 5 = 1$
31. If  $329 + 671 = 1000$ . What is  $2 \times (329 + 671)$ ?
  32. Anil has 137 rupees in a bank and 25 at home, Mohamad has twice as much money as Anil has: write an expression that represents the money Mohamad has and find it.
  33. Manoj has 10 goldfishes and 4 other fishes. Half of all the fishes are female. Write an expression that shows how many fishes are female?

### Take-Home

1. Write a paragraph on how mathematics you have learned is used by a farmer or a housewife or a shopkeeper.
2. A housewife went to buy vegetables with a fifty-rupee note. The prices of the vegetables were as follows:  
 Potatoes - Rs. 8 per kg.  
 Onions - Rs. 6 per kg.  
 Tomatoes - Rs. 12 per kg.  
 Ghiya - Rs. 6 per kg.  
 Beans - Rs. 10 per kg.  
 Formulate questions that the lady may want to answer before picking up her vegetables.
3. Estimate the number of beans in a large jar at home and describe your procedure.
4. Estimate the length of one thousand pins or sewing needles or matches. Describe your procedure.

## Unit Test 3- Basic Geometrical Concepts

1. Give examples of models that come close to the concepts of a
  - (a) point
  - (b) line
  - (c) plane
  - (d) two parallel lines
  - (e) two perpendicular lines
2. Show by drawing lines the number of lines that can be drawn through
  - (a) one point

- (b) two points
- (c) three non-collinear points.

3. Identify the following as parallel lines, perpendicular lines, intersecting lines. If more than one of these holds for a particular figure, write all of them:



(a)



(b)



(c)

4. Points A, B, C, and D are given below:

.A

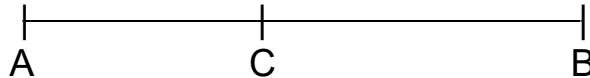
.B

.D

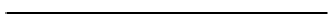
C.

- (a) Draw a line segment AB.
- (b) Draw a line passing through A and C.
- (c) Draw a ray with D as a beginning point.

5. Name all the line segments in the figure given below



6. Measure the length of the line segment given below in centimetres



7. Classify the following figures as open or closed:



(a)



(b)



(c)



(d)

8. Draw on a geo or graph paper a pair of

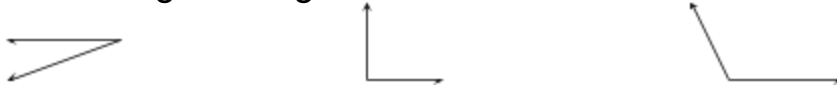
- (a) parallel lines.
- (b) perpendicular lines



9. Draw an angle and name

- (a) its vertex
- (b) its sides
- (c) the angle

10. Which angle is largest? Place a ✓ under it



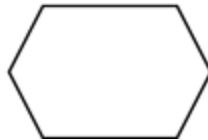
11. Are the following statements true or false? If false, draw a figure that contradicts it.

- (a) A point has a definite location.
- (b) A line extends indefinitely in all directions.
- (c) Two lines in a plane always intersect in a point.
- (d) If points A, B, C, are collinear and points C, D, E are collinear. Then A, B, C, D, E would always be collinear

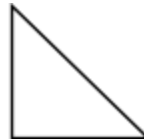
12. Name the following figures:



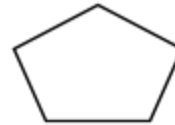
(a)



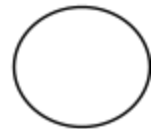
(b)



(c)

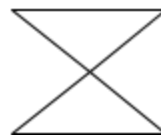


(d)



(e)

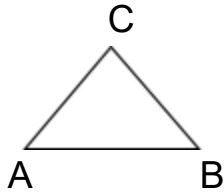
13. Which of the figures given below are not polygons and state the property that prevents it from being a polygon.



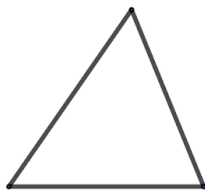
14. Draw and name the following on a dot paper:

- (a) a triangle
- (b) a quadrilateral

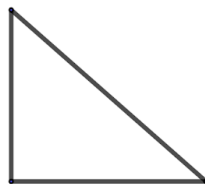
15. For the triangle given below name



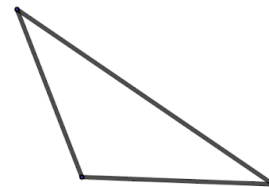
- (a) its sides
  - (b) its angles
  - (c) mark a point P in its interior
  - (d) mark a point Q in its exterior.
  - (e) mark a point D on it
16. Classify the following triangles as acute, obtuse, or right triangles.



(a)



(b)



(c)

17. For the quadrilateral given below name

A

B



C

D

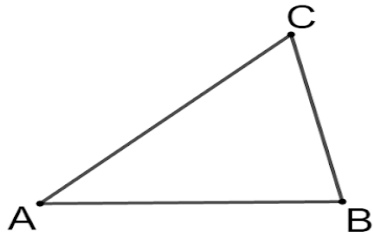
- (a) a pair of its opposite sides
  - (b) a pair of its adjacent sides
18. Draw a circle on a circular dot paper
- (a) Name its centre and radius.
  - (b) Draw and name its diameter.
  - (c) Draw and name a segment of a circle.
  - (d) Draw and name a chord.
  - (e) Mark an arc AB on it
19. Draw a circle with centre O and radius 3 cm.
- (a) Draw and name its radius
  - (b) Draw and name its diameter
  - (c) Draw and name a segment of a circle
  - (d) Draw and name a chord
  - (e) Mark an arc AB on it.

20. Measure all the line segments in the triangle given below correct to the nearest mm.

(a)  $AB =$

(b)  $BC =$

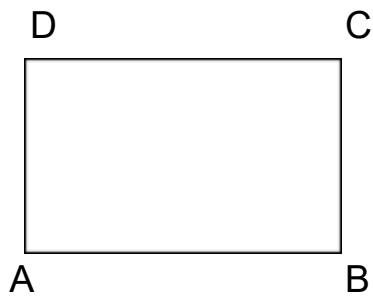
(c)  $CA =$



21. In the rectangle given below, name

(a) a pair of parallel lines

(b) a pair of perpendicular lines



## Unit Test 4-Practical Geometry

1. On a dot or graph paper draw
  - (a) a pair of parallel lines
  - (b) a pair of perpendicular lines
2. Measure the length of line segment AB given below



3. Draw a line segment CD equal to line segment AB given below using a compass and straightedge and explain your procedure.



4. Draw a line segment and draw its bisector. Explain your procedure.
5. Construct a line from a point P perpendicular to the AB
6. Find the measures of the following angles with the help of a protractor:



7. Draw the following angles with a protector:
  - (a)  $30^\circ$
  - (b)  $47^\circ$
  - (c)  $90^\circ$
  - (d)  $140^\circ$
8. Draw the following angles with a compass and straightedge and explain your procedure.
  - (a)  $90^\circ$
  - (b)  $45^\circ$
  - (c)  $60^\circ$
  - (d)  $30^\circ$
9. Draw an angle equal to the angle given below using a compass and straightedge and explain your procedure.

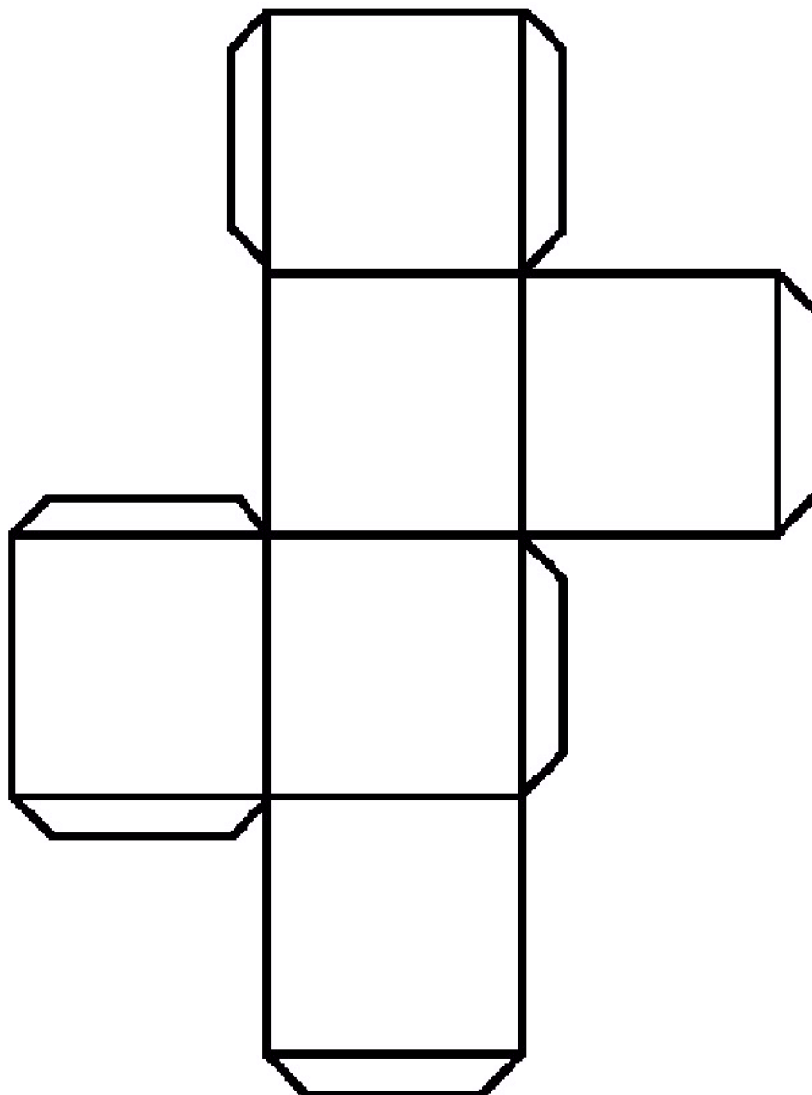


10. Draw an angle and its bisector using a compass and straightedge and explain your procedure.
11. Draw a circle with centre O and a radius of 2.5 cm.

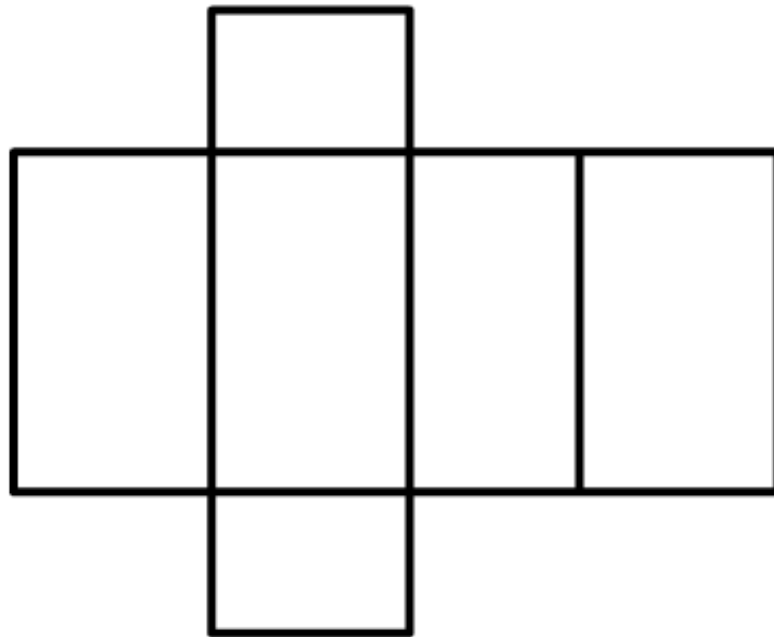
### **Take-Home**

1. Show the following angles by folding a paper
  - (a) an angle of  $90^\circ$
  - (b) an angle of  $45^\circ$
2. Draw a line on a paper and find its midpoint by folding the paper
3. Draw an angle on a paper and divide it into halves by folding the paper
4. Draw the following figures on a graph/dot paper:
  - (a) a square
  - (b) a rectangle
  - (c) a parallelogram
  - (d) a trapezium
  - (e) an isosceles triangle
5. Make different solids from the nets given below. Name these and find the number of vertices, edges, and faces.

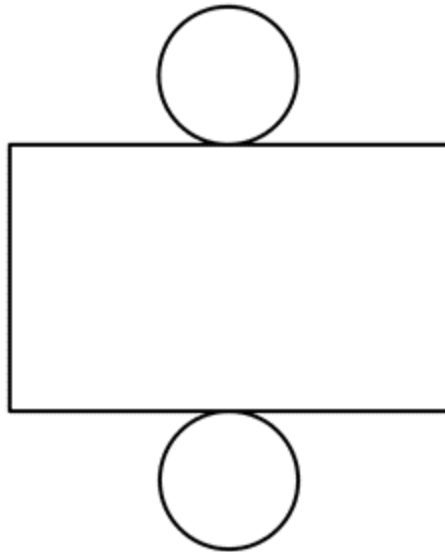
(a) Net for a cube



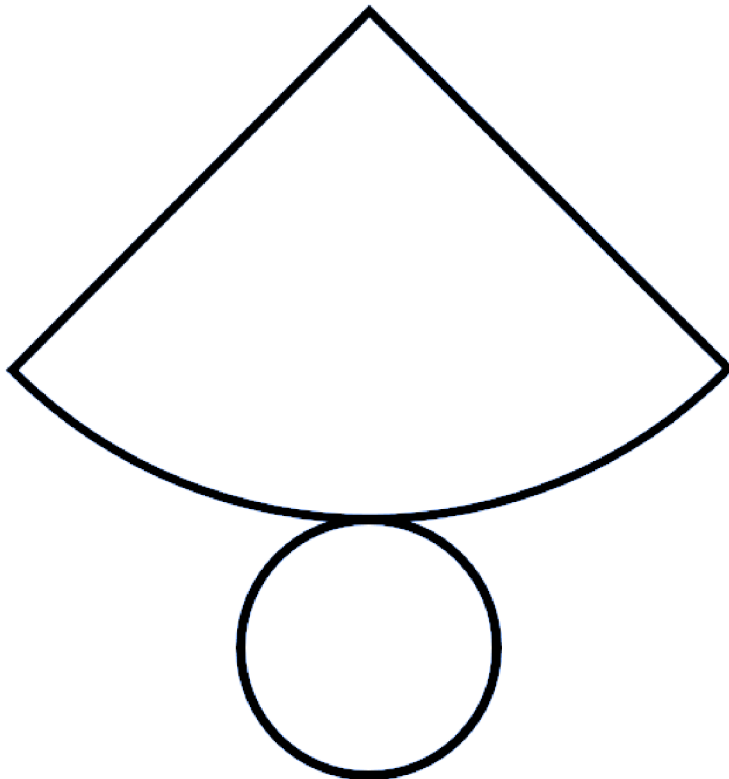
(b) Net for a cuboid



(c) Net for a cylinder



(d) Net for a Cone

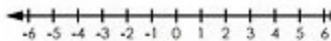




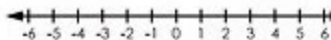
## Unit Test 5-Integers

1. Draw a number line and mark a point
  - (a) A to represent 4 on it.
  - (b) B to represent (-6) on it.
2. Compare the numbers given below by writing the proper inequality  $>$  or  $<$  between them.
  - (a)  $-7$    $4$
  - (b)  $-4$    $-8$
  - (c)  $-5$    $5$
  - (d)  $-2$    $0$
3. Arrange the numbers 0, 13, -18, 8, -5 in order beginning from the smallest integer.
4. Write an integer between -4 and -2.
5. Write all integers between -3 and 2.
6. Show the addition equations given below on the number lines by drawing a curved line starting from the first number to the arrow showing your answer.

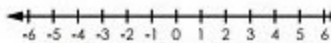
$$-3 + 7 = \underline{\hspace{2cm}}$$



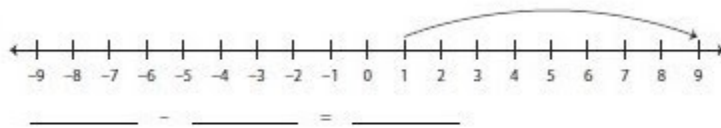
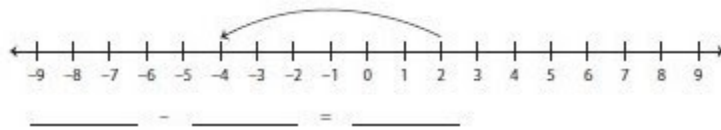
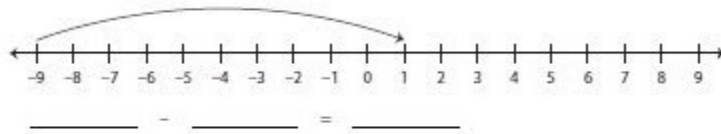
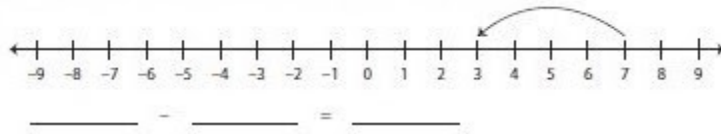
$$2 + [-5] = \underline{\hspace{2cm}}$$



$$-1 + [-2] = \underline{\hspace{2cm}}$$



7. Write the subtraction statements shown on the number lines given below.



8. Simplify

(a)  $5 + (-8)$

(b)  $-3 + (-5)$

(c)  $2 - (-6)$

9. Fill in blanks

(a) \_\_\_\_\_ +  $(-2) = 5$

(b)  $15 - \text{_____} = 17$

(c)  $-198 \times \text{_____} = 198$

(d)  $-3(5 + 7) = -3 \times 5 + \text{_____} \times 7$

(e)  $\{(-2) \times (-3)\} \times 7 = (-2) \times \{(-3) \times (\text{_____})\}$

10. Simplify

(a)  $10 - (5-3)$

(b)  $10 + (2-5)$

11. Are the following statements true or false? If false, give a counterexample.

(a) All whole numbers are integers?

(b) All integers are whole numbers?

12. Describe the need for integers.
13. If  $a$  and  $b$  are any integers, are the following statements true or false any value of  $a$  and  $b$ ? If false, give a counterexample.
- (a)  $a + b$  is an integer
  - (b)  $a - b = b - a$
  - (c)  $a \times b = b \times a$
  - (d)  $a(b - c) = a \times b - a \times c$
14. Formulate problems that would require the following computations:
- (a)  $(-4) + (7)$
  - (b)  $(-500) + (-600)$
  - (c)  $(-500) \times 3$
  - (d)  $(-2000) \div 4$
15. Solve the following problems if enough information is given. If not state what information is missing?
- (a) The temperature in a hill station was below zero at 7 o'clock. In the next hour it increased by  $5^{\circ}\text{C}$ . What was the temperature at 8 o'clock?
  - (b) A mouse started at  $-1$  on a number line and jumped three units along the number line towards the right. Show its final position on the number line.
  - (c) A mouse started at  $2$  on a number line and jumped 5 unit along the number line towards the left. Show its final position on the number line.
16. Write next term of the number series given below
- (a)  $4, 2, 0, -2, \dots$
  - (b)  $7, 3, -1, -5, \dots$

## Unit Test 6-Fractions

1. Shade four-fifth of the objects given below:



2. Shade two-sixths of the objects given below:



3. Arrange

- (a) 15 counters in an array with 3 rows.
- (b) 20 counters in an array with 5 rows
- (c) 24 counters in an array with 4 columns

4. If there are 24 objects in a collection, find the number of objects in five-sixth of the collection.

5. Show the following fractions on a number line:

- (a)  $\frac{1}{2}$
- (b)  $\frac{3}{4}$
- (c)  $\frac{2}{7}$

6. For the fraction  $\frac{3}{7}$  write its

- (a) numerator
- (b) denominator

6. Write a fraction that has 4 as numerator and 5 as denominator.

7. Write  $\frac{4}{7}$  in words.

8. Write one-third in figures

9. Which of the following is a unit fractions

- (a)  $\frac{4}{8}$
- (b)  $\frac{3}{7}$
- (c)  $\frac{1}{3}$
- (d)  $\frac{5}{9}$

10. Write a unit fraction.

11. Encircle a fraction that is like  $\frac{2}{7}$  ?

- A  $\frac{3}{7}$
- B  $\frac{3}{8}$
- C  $\frac{7}{3}$

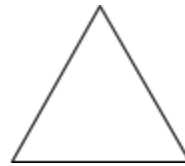
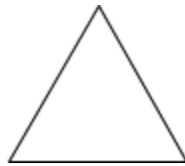
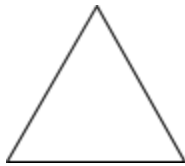
12. Encircle a set of unlike fractions

A.  $\frac{4}{8}$ ,  $\frac{1}{8}$

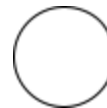
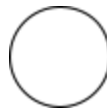
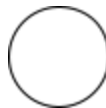
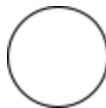
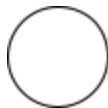
B.  $\frac{3}{7}$ ,  $\frac{5}{8}$

C.  $\frac{1}{3}$ ,  $\frac{3}{9}$

13. Divide the following into 2 equal parts, shade one part, and write it as an improper fraction as well as a mixed number.



14. Divide the following into 4 equal parts and shade one part and write it as an improper fraction as well as a mixed number



15. Write a mixed number.

16. Write a proper fraction.

17. Write an improper fraction.

18. Convert  $\frac{7}{4}$  into a mixed number

19. Convert  $2\frac{2}{3}$  into improper fractions.

20. Compare the following pairs of fractions by writing  $>$ ,  $=$  or  $<$  in the



(a)  $\frac{6}{7}$   1

(b)  $\frac{1}{8}$    $\frac{1}{5}$

(c)  $\frac{4}{5}$    $\frac{2}{3}$

21. Fill in the numerator or denominator in the following fractions so that the fractions are equivalent:

(a)  $\frac{10}{100} = \frac{\square}{10}$

(b)  $\frac{8}{12} = \frac{\square}{3}$

(c)  $1 = \frac{7}{\square}$

(d)  $\frac{4}{7} = \frac{\square}{28}$

22.  $\frac{\Delta}{15}$  is a fraction in lowest form, select the value  $\Delta$  can have:

A. 3

B. 5

C. 10

D. 7

23. Write the following fractions in simplest form:

(a)  $\frac{4}{6}$

(b)  $\frac{10}{15}$   
 (c)  $\frac{24}{36}$

24. Which of the following fraction is less than  $\frac{1}{2}$  ?  
 A.  $\frac{7}{12}$       B.  $\frac{4}{9}$       C.  $\frac{6}{11}$       D.  $\frac{9}{15}$
25. Which of the following fractions is closest to 1?  
 A.  $\frac{1}{2}$       B.  $\frac{2}{3}$       C.  $\frac{5}{6}$       D.  $\frac{8}{9}$
26. Which of the following fractions is closest to  $\frac{1}{2}$  ?  
 A.  $\frac{2}{3}$       B.  $\frac{3}{4}$       C.  $\frac{4}{7}$       D.  $\frac{5}{9}$
27. Add the following fractions:  
 (a)  $\frac{1}{3} + \frac{2}{3}$       (b)  $\frac{3}{8} + \frac{1}{4}$       (c)  $\frac{2}{3} + \frac{3}{4}$
28. Subtract the following fractions:  
 (a)  $\frac{5}{8} - \frac{3}{8}$       (b)  $\frac{5}{6} - \frac{2}{3}$       (c)  $\frac{3}{4} - \frac{1}{3}$
29. When Avani came back from the school  $\frac{3}{4}$  of the cake was left.  
 Her mother gave her  $\frac{1}{8}$  of the original cake. How much cake is left now?
30. Ajay ate  $\frac{1}{2}$  of the pizza in the afternoon and  $\frac{1}{4}$  of the pizza in the evening.  
 (a) How much pizza did he eat in all?  
 (b) How much pizza is left over?
31. Describe how fractions are used in daily life.

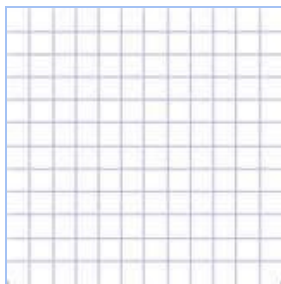
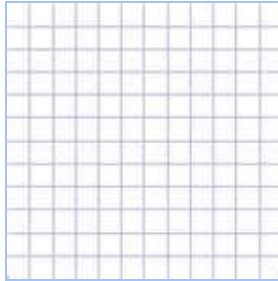
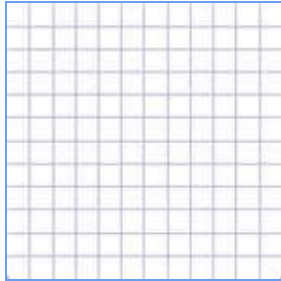
## Unit Test 7-Decimals

1. If each figure given below represents one unit. Shade the following portions of it.

(a) 0.74

(b) 0.50

(c) 0.08



(i)

(ii)

(iii)

2. Compare the following decimals by writing  $<$ ,  $>$ , or  $=$  in

(a) 0.46  0.63

(b) 0.40  0.4

(c) 0.5  0.35

3. Express the following as a decimal.

(a)  $\frac{3}{4}$

(b)  $\frac{15}{10}$

(c)  $\frac{8}{100}$

4. Express the following as a fraction.

(a) 0.80

(b) 1.25

(c) 0.07

5. Show the numbers given below on a number line.

(a) 0.3

(b) 4.5

(c) 7.83

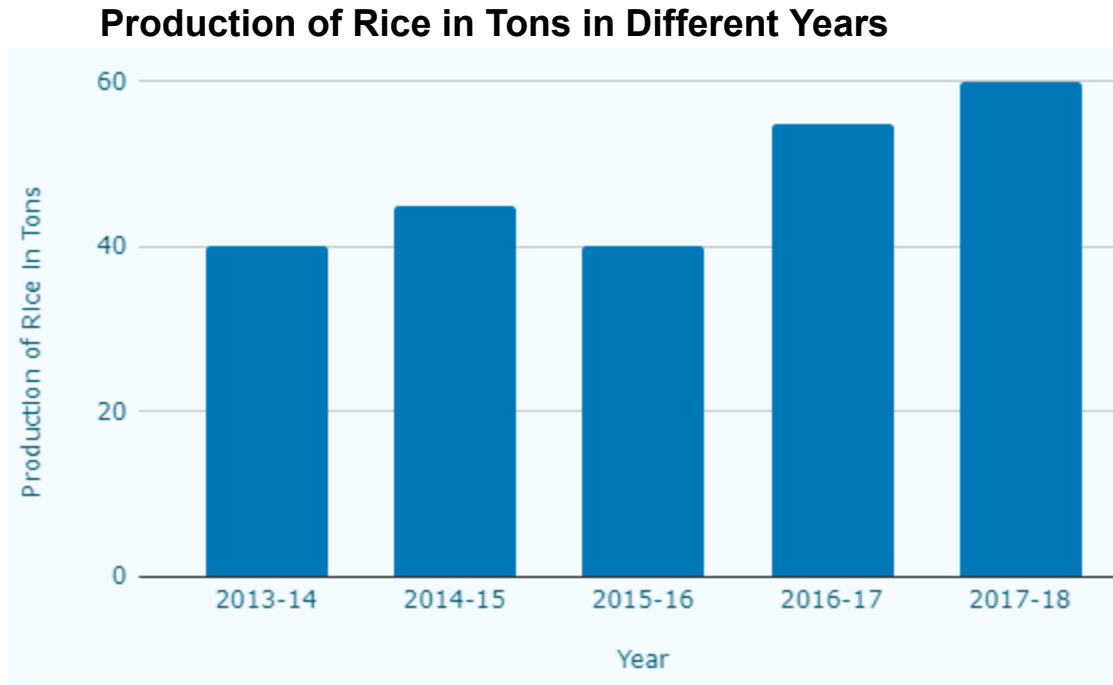
6. Write the place values of the underlined digit in the numbers given below.
- (a) 4.853
  - (b) 56.732
  - (c) 54.761
  - (d) 372.5
7. Write the numbers given below in decimal form.
- (a)  $5 + \frac{3}{10} + \frac{7}{100}$
  - (b)  $4 + \frac{9}{100}$
  - (b)  $6 + \frac{1}{10} + \frac{5}{100} + \frac{8}{1000}$
  - (c)  $34 + \frac{7}{100} + \frac{4}{1000}$
8. Write the numbers given below in expanded form.
- (a) 3.4
  - (b) 4.57
  - (c) 7.853
  - (d) 3.087
9. How many millilitres are in one litre?
10. Express the following in millilitres:
- (a) 2 litres
  - (b) 1.5 litres
  - (c) 1.25 litres
  - (d) 1.356 litres
11. Express the following in litres:
- (a) 250 ml
  - (b) 50 ml
  - (c) 5 ml
12. Express the following in centimetres:
- (a) 4 metres
  - (b) 1.25 metres
  - (c) 1.05 metres
13. Express the following in metres:
- (a) 1m 25 cm
  - (b) 62 cm
  - (c) 5 cm
14. Express the following in millimetres:
- (a) 2 cm
  - (b) 1.7 cm



15. Express the following in centimetres:
  - (a) 5 mm
  - (b) 23 mm
16. Express the following in rupees
  - (a) 1 rupee and 50 paise
  - (b) 15 paise
  - (c) 5 paise
17. A Sweet maker bought 12 litres of milk; he used 6.25 litres of milk for one sweet, how much milk is left over?
18. Rama needs 2.50 metres for making a shirt and 2 metres for making a salwar, how much cloth should she buy for a suit?
19. Yash bought a book worth Rs. 12.50 and a pen worth Rs. 6.25
  - (a) how much money he should pay the shopkeeper?
  - (b) If he gave the shopkeeper a hundred-rupee note, how much money should the shopkeeper return to him?
20. A toothpaste costs Rs.10 for 200 ml and Rs 18 for 400 ml toothpaste. How much would you save if you bought a 400 ml toothpaste instead of two 200 ml toothpastes?
21. Make up stories for the following computations:
  - (a)  $13.50 + 10.50 = 24$
  - (b)  $16 - 3.5 = 12.5$








## Unit Test 8-Data Handling
























1. The Bar-graph given below shows the production of rice in tons in recent years:




- (a) How much was the crop production of rice in 2015-16?
  - (b) In which year the crop production was maximum?
  - (c) In which year the crop production was minimum?
  - (d) How much was the increase in the production of rice crops from the year 2013-14 to the year 2017-18?
  - (e) What trend about rice production do you notice over the time period?
2. The following pictograph gives the number of children rounded to the nearest 5 in different classes in a rural primary school.



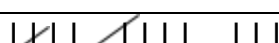

### Number of Children in a Primary School

Class	Number of children in different classes
I	      

II	      
III	     
IV	    
V	    

 = 5 children

- How many children does a face represent?
  - How many children are there in class I?
  - How many children are there in class III?
  - Which class has the maximum number of children?
  - Which class has the minimum number of children?
  - Do you notice a trend as we move from class 1 to higher classes?
  - Make a bar graph of the above data on graph paper.
2. The data of a class about their favorite TV program is recorded in the Tally Chart given below

TV programme	Number of students who prefer the programme
Cartoons	
Serials	
Movies	
Sports	

- How many children prefer to see cartoons?
- How many children prefer to see movies?
- How many more children prefer to see cartoons rather than serials?

- (d) Make a pictograph of the data given in the above table using a smiley face to represent 2 children.
- (e) Make a bar graph of the above data. Does it provide the same information as a pictograph?
- 3. Give situations in which you will represent a smiley face or any other object to represent
  - (a) 1 object or person
  - (b) more than 1 object or person.

### Project

Pass on paper or cards to the whole class to give their responses to questions such as what is your favourite ice cream, what do you like to do in your free time, what kind of books do you like to read fiction or nonfiction, and other data they may be interested in. Ask them to write the answers to each of these on a separate paper and collect answers to each question one at a time.

Form groups of 4 children and pass to each group data collected from all the students in the class to a question. Ask each group to do the following:

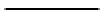
Record the data in the table given below by filling in the entries in the first row and first column and making a tally chart of the data


- (a) Make a pictograph with a picture representing objects or persons.
- (b) Give a heading to the table.

- (c) Make a bar graph of the above data.
- (d) Present findings to the class.
- (e) Does the table, pictograph, and bar graph provide the same information?
- (f) Which representation of data would you prefer and why?

## Unit Test 9-Mensuration

1. Draw a line segment whose length is three times the length of the line segment given below. Explain your procedure



2. Measure the length of the line segment given below in centimetres



3. Fill in the blanks:

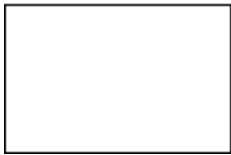
1 cm = \_\_\_\_ mm

1 cm = \_\_\_\_ m

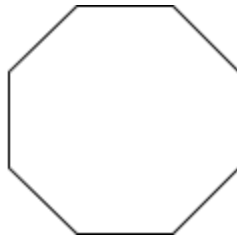
2.5 cm = \_\_\_\_ mm

1 km = \_\_\_\_ m

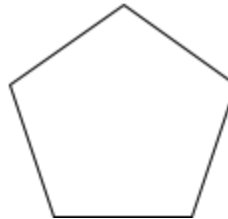
4. Name the figure given below and find their perimeter by measuring the length of their sides.



(a)



(b)



(c)

5. Draw the following figures on a cm dot or graph paper so that they have the given perimeter:

(a) A square with a perimeter of 12 cm.

(b) A rectangle with a perimeter of 10 cm..

(c) A rectangle with a perimeter is 14 cm.

6. Find the parameter of the following figures with the help of wool



(a)

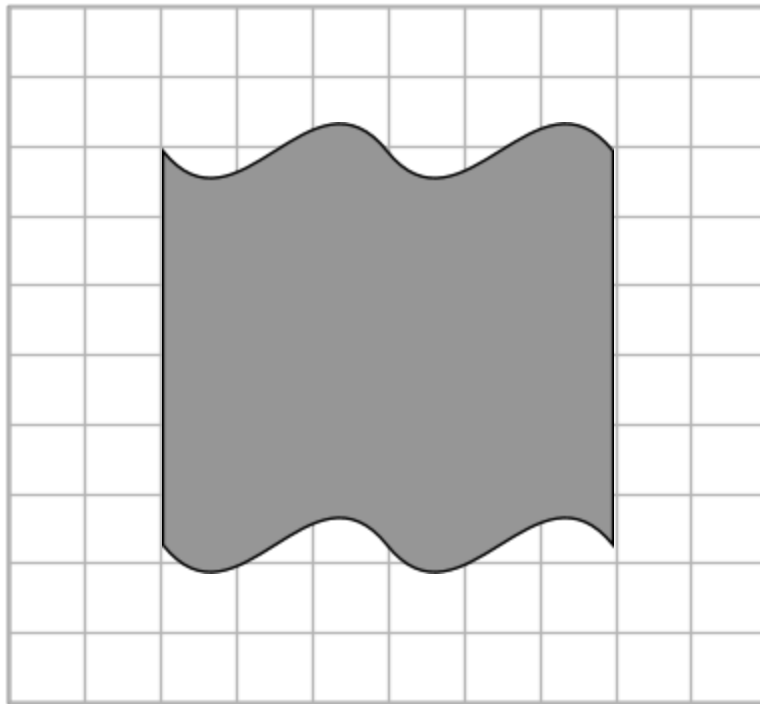


(b)



(c)

7. Anurag ran around a rectangular field whose length is 150 metres and breadth is 100 metres. How much distance did he run in  
(a) 1 round. (b) 4 rounds.
8. The side of a square baby sheet is 1.25 metres. You want to fix a lace around it, how much lace should you buy?
9. Draw all the rectangles you can on the cm graph/dot paper whose area in  $\text{cm}^2$  is given below:  
(a) 6 (b) 10 (c) 5
10. On a cm. graph paper shade rectangles whose area and perimeter are as follows:  
(a) Area  $1 \text{ cm}^2$  and perimeter 4 cm.  
(b) Area  $6 \text{ cm}^2$  and perimeter 10 cm.
11. Find areas of rectangles whose length and breadth are given below:  
(a) Length = 4 cm and breadth = 3 cm  
(b) Length = 2 cm and breadth = 5 cm
12. Find the area of squares whose sides are given below:  
(a) 4 cm (b) 3 cm
13. Estimate the area of the figure given below the area of a square is one square centimetre.



14. Draw and cut a square into two pieces.  
(a) Would the sum of their areas be the same as that of the

original square?

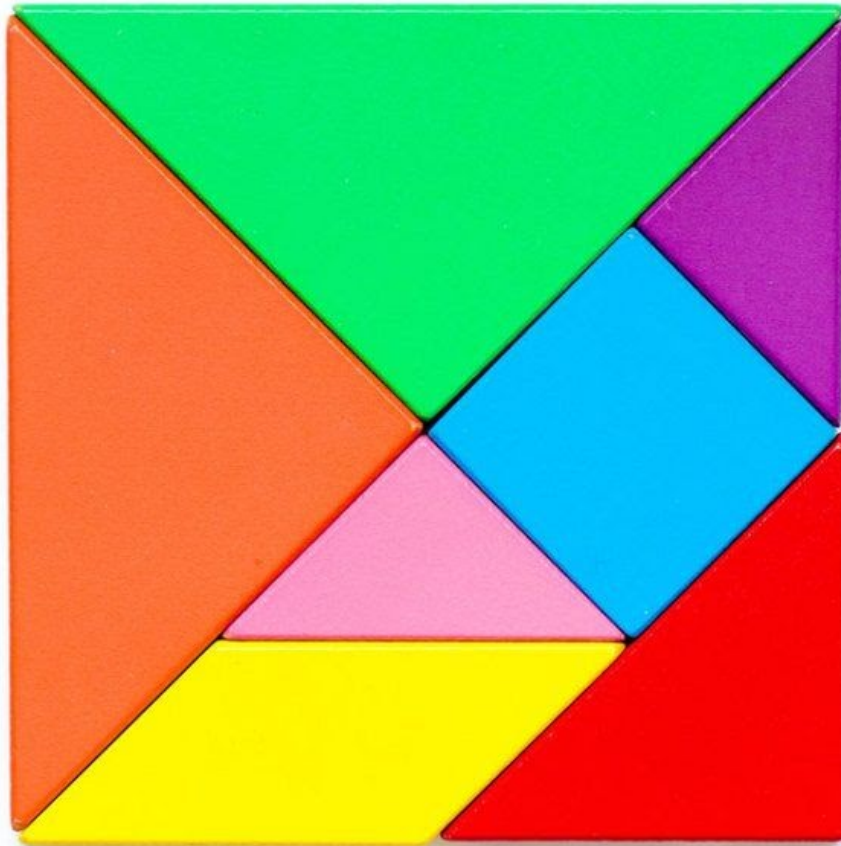
(b) Would the sum of their perimeters be the same as that of the original square?

15. Tanya wants to make a quilt using her 12 square pieces. How should she arrange her pieces so that the lace required would be minimum?
16. Collect some objects e.g. leaves, coins, CDs, and find the area of their faces using graph paper.
17. How would you find the length of a tangled rope which is difficult to entangle? Describe your procedure.



## Take-Home

Trace and cut the figures given below and let the square represent one unit for all the questions given below:



1. Make a square with the two small triangles.  
(a) What is the area of this square? How did you find out?  
(b) What is the area of the small triangle used? How do you know?
2. Make a (non-square) parallelogram with the two small congruent triangles. What is the area of this parallelogram? How do you know?
3. Make a triangle with the two small congruent triangles. What is the area of this triangle? How do you know?
4. Make a square with a medium-sized triangle and the two small congruent triangles. What is the area of this square? How did you

find out? What is the area of the medium triangle? How did you find out?

5. Make a rectangle with the parallelogram and the two small congruent triangles. What is the area of this rectangle? How did you find out?
6. Make a square with the two large congruent triangles. What is the area of this square? How do you know?
7. What is the area of the square that you traced?

## Unit Test 10-Basic Concepts in Algebra

1. Write the following using numbers, literal numbers, and signs of fundamental operations.
  - (a) Ragini is 7 years older than Asha. If Asha's age is  $x$ , what is Ragini's age?
  - (b) The cost of a ball pen is 3 times the cost of a pencil. If the price of the pencil is  $x$ , what is the price of the ball pen?
  - (c) The daily wages of a labourer are half of the daily wages of a skilled worker. If the wage of a skilled worker is  $x$ , what is the wage of the labourer?
  - (d) The length of a field is 3 metres more than its breadth. If its length is  $y$  metres then what is its breadth?
  - (e) Aman is twelve years old now, what would be his age after 5 years?
2. Write the following using numbers, literal numbers, and signs of fundamental operations (+, -,  $\times$ , and  $\div$ ).
  - (a) the sum of  $x$  and 4
  - (b) 7 less than  $y$
  - (c) one-third of  $b$
  - (d) four times five.
3. Fill in the blanks :
  - (a)  $n + 4 = \underline{\hspace{2cm}} + n$
  - (b)  $n \times 6 = 6 \times \underline{\hspace{2cm}}$
  - (c)  $a.(b + c) = a.b + \underline{\hspace{2cm}}$
  - (d)  $(ab).c = \underline{\hspace{2cm}}.(bc)$
4. Write the formulae (mathematical rule) for the following indicating what literal numbers represent:
  - (a) The area of a rectangle is equal to be the product of its length and breadth.
  - (b) The perimeter of a square is four times its side
5. Simple interest  $I$  is given by the following formula:  
 $I = Prt$ , where  $P$  denotes the principal,  $r$  the annual rate of interest, and  $t$  the time in years. Find the simple interest on Rs. 1000 at a rate of 5 percent per annum for 2 years.
6. The speed of a train is given by  
 $s = \frac{d}{t}$  km./hour, where  $d$  is the distance in km. and  $t$  the time in hours

it takes to cover the distance d. If a train covered 90 km in 2 hours.  
Find its speed.

7. Which statements are true for all values of x? Select all that apply.

☐  $x + 4 = 7$

☐  $2(x + 4) = 2x + 2 \times 4$

☐  $3x = 15$

☐  $x \times 0 = 0$

8. Which of the following statements are true for only one value of x?  
Check all that apply.

☐  $x + 2 = 5$

☐  $5x = 5 \times x$

☐  $3x = 9$

☐  $3(2x - 2) = 6x - 6$

9. Find x

(a)  $x - 7 = 5$

(b)  $\frac{x}{3} = 4$

(c)  $4x = -8$

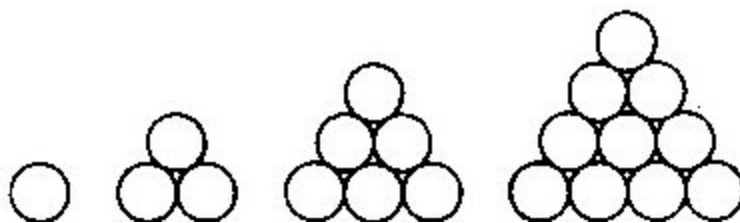
(d)  $3x + 7 = 13$

10. I am thinking of a number if I double it and add six to it, I get 30.  
What is my number?

11. Ankit is 3 years older than Arti. If the sum of the ages of Ankit and Arti is 13, Find the ages of Ankit and Arti.

12. Look at the figures given below, write the number of balls or matches you will need for the next figure and the  $n^{th}$  figure.

(a)



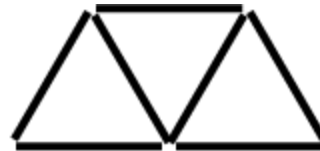
(b)



1-triangle path



2-triangle path

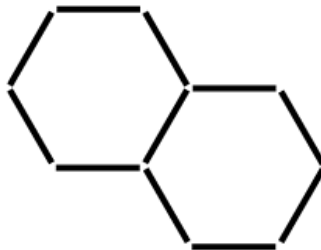


3-triangle path

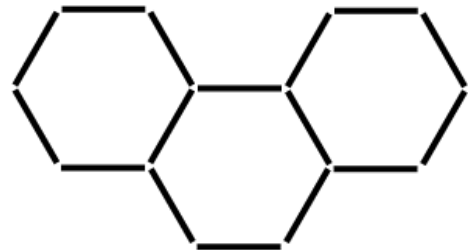
(c)



1-hexagon path

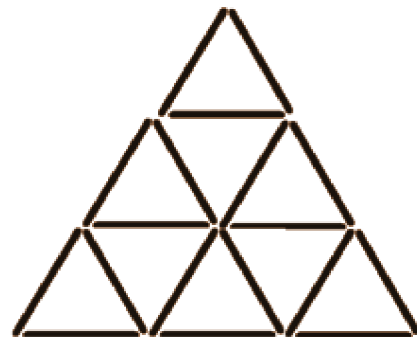
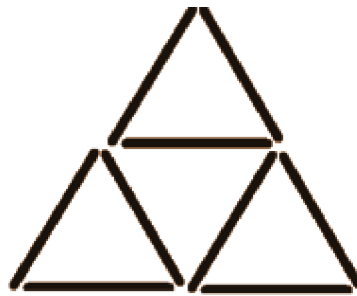


2-hexagon path



3-hexagon path

(d)



13. For the numbers series given below, write the next term and the  $n^{th}$  term
- (a) 2, 4, 6, 8, 10, \_\_\_\_\_, \_\_\_\_\_.
  - (b) 1, 3, 5, 7, 9, \_\_\_\_\_, \_\_\_\_\_.
  - (c) 1, 4, 9, 16, 25, \_\_\_\_\_, \_\_\_\_\_.
  - (d) 1, 3, 6, 10, 15, \_\_\_\_\_, \_\_\_\_\_.

## Unit Test 11- Ratio, Proportion, and Unitary Method

1. Write the following as a ratio
  - (a) Daily wage of a mason is double the daily wages of a labourer.
  - (b) The breadth of a rectangular field is two-third of its length.
2. Write the following ratios in simplest form.
  - (a) 60 paise per 3 rupees
  - (b) 1 hour per 5 minutes
3. Sushila earned Rs 40,000 in a year. She saved Rs 2000 that year. Find the ratio of her income to savings.
4. Draw two line segments AB and CD whose lengths are in the ratio of 3:5.
5. Fill in the blanks.
  - (a)  $6:3::\_\_\_:9$
  - (b)  $9:6::6:\_\_\_$
6. In a mixture, the weight of copper and zinc are in the ratio of 5:3. If the weight of zinc is 9 kg., find the weight of copper.
7. Ram and Shyam invested money in the ratio of 3:4 in a business. If their total investment was Rs. 35000. How much money was invested by Ram?
8. An airplane covers a distance of 4000 km. in 5 hours. How far would it travel in 2 hours?
9. The cost of a box of 6 pencils is Rs. 15, what is the cost of
  - (a) one pencil
  - (b) three pencils
10. The cost of a 100 ml toothpaste tube is 11 rupees and the cost of a 200 ml toothpaste tube is Rs.18.50, How much do you save by buying one 200 ml toothpaste tube rather than 2 tubes of 100 ml toothpastes?
11. The cost of a bag of 5 kg. of potatoes is Rs.40, How much you would have to pay if you bought
  - (a) 1 kg. of potatoes
  - (b) 3 kg. of potatoes
  - (c)  $\frac{1}{2}$  kg. of potatoes
12. Eggs are being sold for Rs 30 per dozen. If you have Rs 18, can you buy 8 eggs?

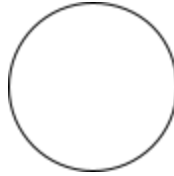
13. A car travels 80 miles in 2 hours. How much time will it take to cover a distance of 20 miles?

## Unit Test 12- Symmetry

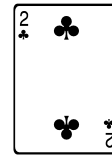
1. Which of the following figures are symmetrical?



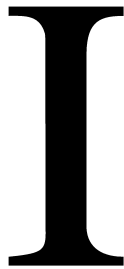
(a)



(b)



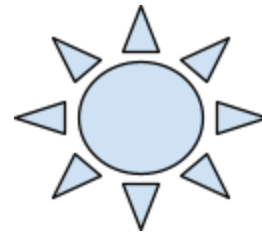
(c)



(d)



(e)

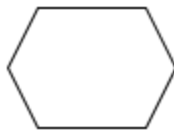


(f)

2. How many lines of symmetry are there in the following figures?



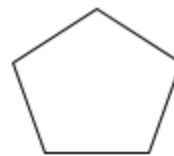
(a)



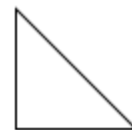
(b)



(c)



(d)



(e)

3. Find the number of lines of symmetry in the following letters:

Z

(a)

S

(b)

H

(c)

E

(d)

O

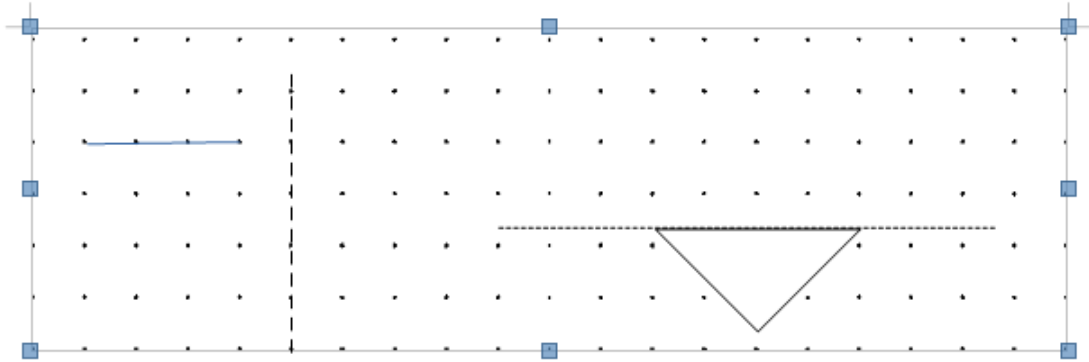
(e)

T

(f)



4. Complete the following figures so that the dashed line is a line of symmetry:



### Take-Home

1. Trace and cut the figures given below to find all lines of symmetry by folding these.


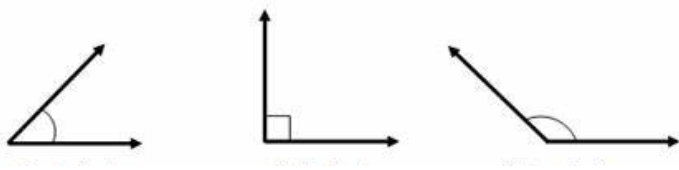

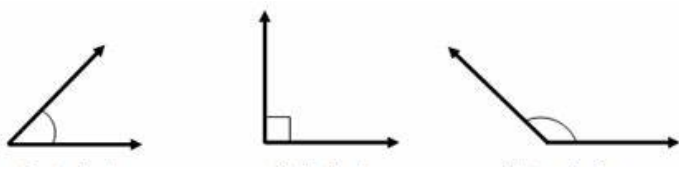


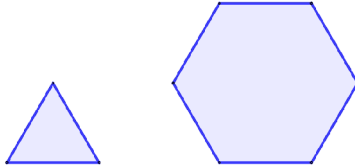
- (a) (b) (c) (d) (e) (f)
2. Draw the following figures and a line of symmetry on a dot paper and its reflection.
- (a) a right triangle
- (b) an angle
3. Find some pictures of objects that are symmetrical, paste them in your notebook, and draw lines of symmetry in those.
4. Fold a piece of paper and draw figures along the fold and cut the outline. Unfold and paste these in your notebook.
5. Draw figures on a dot paper that have the following number of lines of symmetry.
- (a) 0 (b) 2 (c) 4

## Criterion Test in Mathematics

Item Number	Objective	Item
1	Knowledge	Write 20,14,707 in words in Indian system of numeration.
2	Understanding	Fill in the blank $98 \times 47 = 47 \times \underline{\hspace{2cm}}$
3	Understanding	Use a shortcut to find $567 \times 348 - 567 \times 48$
4	Knowledge	Find HCF of 12 and 15.
5	Application	Two bells start tolling at the same time and they toll regularly at intervals of 12 and 18 seconds. At what interval of time they will toll together at the same time.
6	Knowledge	Fill in the missing denominator in the fraction so that the fractions are equivalent: $\frac{4}{5} = \frac{12}{\square}$
7	Application	Ajay ate $\frac{1}{3}$ of the pizza in the afternoon and $\frac{1}{6}$ th of the pizza in the evening. How much pizza did he eat in all?
8	Knowledge	Convert $\frac{3}{4}$ into a decimal number.
9	Application	A Sweet maker bought 12 litres of milk; he used 4.75 litres of milk for one sweet, how much milk is left over?
10	Knowledge	Find

		(a) $-7 + 4$ (b) $-6 - (-3)$
11	Transfer	If $a > b$ , where $a$ and $b$ are whole numbers. Is $-a > -b$ ? If not, give a counterexample.
12	Knowledge	Express the ratio of 50 paise to 3 rupees in the simplest form.
13	Application	Anil and Suneel invested money in a business in the ratio of 2 : 3. If the total investment was Rs. 24,000, find the sum invested by Anil.
14	Knowledge	Is $20:25::12:15$ ?
15	Transfer	Sunita wants to send a parcel weighing 1.40 kilograms. The post office charges Rs.3 for every 400 gms or part of 400 gms. How much Sunita would have to pay for sending the parcel?
16	Application	The daily wages of a skilled worker is Rs.30 more than that of a daily labourer. If the wage of a labourer is $x$ , what is the wage of the skilled worker?
17	Transfer	The Principal of a school donated Rs. 100 to a student's sports club and each member of the club donated Rs.2 for a function. If there are $n$ members of the club, write a mathematical expression for total collection.
18	Knowledge	The area of a triangle is given by $\frac{1}{2}$ base $\times$ height Find the area of a triangle whose base is 5 cm and height is 3 cm.

19	Knowledge	<p>In the figure given below place a <math>\checkmark</math> under the 1 line.</p> 
20	Understanding	How many lines can be drawn passing through one point?
21	Understanding	<p>Which of the following angles is an obtuse angle?</p> 
22	Application	Draw an acute angle.
23	Application	At what time minute hand and the hour hand will make a straight angle?
24	Understanding	<p>Give an example from the environment of</p> <p>(a) parallel lines</p> <p>(b) a sphere</p>
25	Understanding	<p>Which of the following is a cone? Place an <math>\checkmark</math> under it.</p> 
26	Knowledge	Complete the following figures so that the dashed line is the line of symmetry
27	Knowledge	<p>Measure the angle given below with the help of a protractor.</p> 

28	Transfer	Draw and cut a square into two pieces. Would the sum of their perimeters be the same as that of the original square?												
29	Transfer	<p>If the triangle given below is taken as a unit of area and find the area of the hexagon.</p> <div></div>												
30	Knowledge	<p>The table given below gives favourite sweet of Students of class VI</p> <table><tr><th>Name of the Sweet</th><th>Number of Students having the sweet as a favourite</th></tr><tr><td>Ladoo</td><td>8</td></tr><tr><td>Balushahi</td><td>9</td></tr><tr><td>Burfi</td><td>6</td></tr><tr><td>Rasgulla</td><td>5</td></tr><tr><td>Other</td><td>7</td></tr></table> <p>(a) Which sweet is preferred by most students? (b) Make a bar graph of the above data.</p>	Name of the Sweet	Number of Students having the sweet as a favourite	Ladoo	8	Balushahi	9	Burfi	6	Rasgulla	5	Other	7
Name of the Sweet	Number of Students having the sweet as a favourite													
Ladoo	8													
Balushahi	9													
Burfi	6													
Rasgulla	5													
Other	7													

## TESTS FOR CLASS VII

### Pretest 1-Fundamental Operations on Fractions

1. Find the LCM of the following numbers
  - (a) 3, 4
  - (b) 16, 20
  - (c) 3,12
2. Find the HCF of the following numbers:
  - (a) 5, 7
  - (b) 6,18
  - (c) 12,15
3. For the fraction  $\frac{3}{4}$  write its
  - (a) numerator
  - (b) denominator
4. Fill in the boxes with numbers, so that the following fractions are equivalent:
  - (a)  $\frac{3}{4} = \frac{6}{\square}$
  - (b)  $\frac{5}{10} = \frac{\square}{2}$
  - (c)  $1 = \frac{7}{\square}$
5. Reduce the following to lowest terms:
  - (a)  $\frac{4}{8}$
  - (b)  $\frac{6}{18}$
6. Simplify
  - (a)  $\frac{1}{7} + \frac{3}{7}$
  - (b)  $\frac{1}{2} + \frac{3}{4}$
  - (c)  $\frac{2}{5} + \frac{2}{3}$
  - (d)  $2\frac{1}{2} + 3\frac{2}{3}$
7. Simplify
  - (a)  $1 - \frac{4}{7}$

(b)  $\frac{2}{3} - \frac{1}{6}$

(c)  $\frac{7}{8} - \frac{3}{5}$

(d)  $3\frac{1}{2} - 2\frac{3}{10}$

(e)  $4\frac{1}{3} - 2\frac{2}{3}$

8. A housewife bought 2 kg. of rice. She cooked  $\frac{1}{2}$  kg. of rice in one day and  $\frac{3}{4}$  kg. of rice on another day.

(a) How much rice did she use?

(b) How much rice is left over?

9. Find the following and describe a situation in daily life for which the following computations would be required:

(a)  $2 - \frac{1}{3}$

(b)  $2\frac{1}{2} + 3 =$

## Pretest 2-Decimals

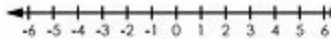
1. Write the fractions given below as decimals
  - (a)  $\frac{1}{2}$
  - (b)  $\frac{1}{4}$
  - (c)  $\frac{1}{3}$
2. Write the decimals given below as fractions
  - (a) 0.6
  - (b) 0.75
  - (c) 0.04
3. Write the numbers given below in ascending order.  
1, 0.7, 0.07, 0.71
4. Write the decimals for the following numbers.
  - (a) three-tenths
  - (b) eight-hundredths
  - (c) five and seven-hundredths
5. Round off the following numbers as indicated
  - (a) 6.82 to the nearest tenth.
  - (b) 5.98 to the nearest tenth.
  - (c) 7.02 to the nearest whole number.
6. Add
  - (a) 
$$\begin{array}{r} 0.39 \\ +0.43 \\ \hline \end{array}$$
  - (b) 
$$\begin{array}{r} 0.482 \\ + 0.573 \\ \hline \end{array}$$
  - (c)  $8.23 + 12.4 + 0.6$
7. Subtract
  - (a) 
$$\begin{array}{r} 0.67 \\ -0.51 \\ \hline \end{array}$$
  - (b) 
$$\begin{array}{r} 4.000 \\ -1.273 \\ \hline \end{array}$$
  - (c)  $5 - 3.2$
8. Describe a situation for which the following computations would be required?
  - (a)  $2 + 1.75 + 0.75 = 4.50$
  - (b)  $5 - 2.50 = 2.50$



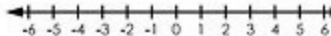
## Unit Test 1-Integers

1. Draw a number line and mark a point
  - (a) A to represent 3 on it.
  - (b) B to represent -5 on it.
2. Compare the numbers given below by writing the proper inequality  $>$  or  $<$  for the box
  - (a)  $-7$    $4$
  - (b)  $-4$    $-8$
  - (c)  $-5$    $5$
  - (d)  $-2$    $0$
3. Write an integer between -4 and -2.
4. Write all integers between -3 and 2.
5. Simplify
  - (a)  $5 + (-8)$
  - (b)  $-3 + (-5)$
  - (c)  $2 - (-6)$
6. Using a number line find

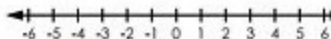
$$-3 + 7 = \underline{\hspace{2cm}}$$



$$2 + [-5] = \underline{\hspace{2cm}}$$



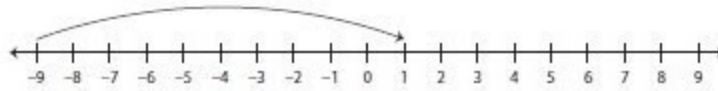
$$-1 + [-2] = \underline{\hspace{2cm}}$$



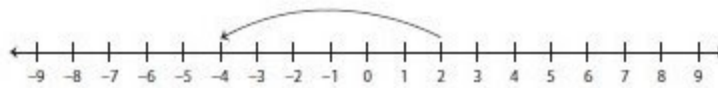
7. Write the subtraction equations shown on the number lines given below.



$$\underline{\hspace{1cm}} - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$



$$\underline{\hspace{1cm}} - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$



$$\underline{\hspace{1cm}} - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$



$$\underline{\hspace{1cm}} - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

8. Simplify

(a)  $(-7) \times 3$

(b)  $(-6) \times (-4)$

(c)  $8 \div (-2)$

(d)  $-9 \div (-3)$

9. Fill in blanks

(a)  $\underline{\hspace{1cm}} + (-2) = 5$

(b)  $15 - \underline{\hspace{1cm}} = 17$

(c)  $-198 \times \underline{\hspace{1cm}} = 198$

(d)  $-3(5 + 7) = -3 \times 5 + \underline{\hspace{1cm}} \times 7$

(e)  $\{(-2) \times (-3)\} \times 7 = (-2) \times \{(-3) \times (\underline{\hspace{1cm}})\}$

10. Simplify

(a)  $10 - (5 - 3)$

(b)  $10 + (2 - 5)$

11. If  $a$  and  $b$  are any integers, are the following statements true for any value of  $a$  and  $b$ ? If not, give a counterexample.

(a)  $a + b$  is an integer

(b)  $a - b = b - a$

- (c)  $a \times b = b \times a$
- (d)  $a(b + c) = a \times b + a \times c$
12. State, whether the statement -Multiplication of two proper fractions will give a fraction  $> 1$ , is true or false. If false, give a counterexample.
13. Are the following statements true or false? If false, give a counterexample.
- (a) All whole numbers are integers?
- (b) All integers are whole numbers?
14. Describe the need for integers.
15. Arrange in ascending order the numbers 0, 13, -18, 8, -5.
16. Formulate problems that would require the following computations:
- (a)  $(-4) + (7)$
- (b)  $(-500) + (-600)$
- (c)  $(-500) \times 3$
- (d)  $(-2000) \div 4$
17. Solve the following problems if enough information is given. If not, state what information is missing?
- (a) The temperature in a hill station was below zero at 7 o'clock. In the next three hours, it increased by  $5^\circ$  what was the temperature at 10 O'clock.
- (b) A mouse started at zero on a number line and jumped three units at a time three times along the number line towards the right, turned around and jumped three units at a time 5 times again along the number line toward left. Find its position and show it on the number line.
18. Write next term of the number series given below
- (a) 4, 2, 0, -2, \_\_\_\_
- (b) 3, -9, 27, -81, \_\_\_\_

## Unit Test 2-Fractions and Decimals

1. Write a fraction between  $\frac{1}{4}$  and  $\frac{1}{2}$ .
2. Would  $80 \div \frac{3}{4}$  be more or less than 80?
3. Would  $50 \times \frac{2}{3}$  be more or less than 50?
4. Simplify and express in simplest form
  - (a)  $\frac{1}{3} \times 12$
  - (b)  $\frac{3}{4} \times \frac{2}{7}$
  - (c)  $\frac{15}{7} \times \frac{3}{5}$
5. What is the reciprocal of  $\frac{2}{5}$ ?
6. Simplify
  - (a)  $6 \div \frac{1}{2}$
  - (b)  $\frac{2}{3} \div 4$
  - (c)  $\frac{1}{2} \div \frac{2}{3}$
  - (d)  $\frac{1}{4} \div 3$
  - (e)  $1\frac{3}{8} \div 4$
7. If each child is to be given a cup containing one-fourth of a litre of milk, how much milk would be needed for 50 children?
8. How many ribbons of length  $\frac{3}{4}$  metres can be cut from a roll of ribbon containing 12 metres?
9. Describe situations in which the following computations would be required:
  - (a)  $\frac{1}{2}$  of  $\frac{3}{4}$
  - (b)  $3 \div \frac{1}{2}$
10. Plot the following numbers on a number line.
  - (a) 3.5
  - (b) 2.56
11. Express 4.725 in expanded form.
12. Round 5.647 to the nearest
  - (a) whole number.

- (b) tenth.  
(c) hundredth,
13. Simplify
- (a)  $2.5 + 4.73 + 5.02$
  - (b)  $4.3 - 2.75$
  - (c)  $2.0 - (1.25 + 0.5)$
  - (d)  $4.3 \times 28$
  - (e)  $4.5 \times 2.8$
  - (f)  $7.3 \times 1.23$
  - (g)  $4.5 \div 5$
  - (h)  $5.6 \div 1.4$
  - (i)  $6.4 \div 0.16$
  - (j)  $0.6 \div 100$
14. Express the fractions given below as decimals:
- (a)  $\frac{1}{10}$
  - (b)  $\frac{5}{100}$
  - (c)  $\frac{1}{4}$
  - (d)  $\frac{11}{6}$
15. Express the decimal numbers given below in the form  $p/q$  where  $p$  and  $q$  are whole numbers
- (a) 0.24
  - (b) 0.155
  - (c) 1.49
  - (d) 0.02
16. Find the area of a rectangle whose length and width are 1 foot and  $1\frac{2}{3}$  feet respectively.
17. Find the perimeter of a square whose side is equal to  $4\frac{1}{3}$  inches.
18. Arrange 0.7,  $\frac{5}{7}$ ,  $\frac{2}{3}$ , 0.67 in order from least to greatest.
19. Anil can do a job in  $3\frac{3}{4}$  hours and Manoj can do the same job in  $\frac{1}{3}$  <sup>rd</sup> of that time. How many hours will it take Manoj to do

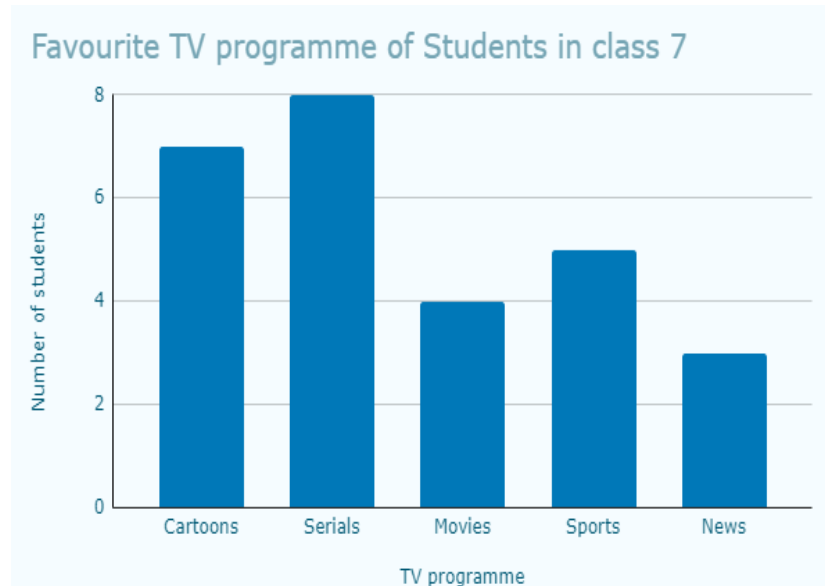
the job?

20. A strip of metal 16.5 in. long is to be cut into 5 equal pieces.  
What is the length of each part?

## Unit Test 3-Data Handling

1. The scores of 10 students in a test are given below:  
5, 3, 7, 8, 5, 9, 2, 5, 4, and 6  
Find
  - (a) mean
  - (b) median
  - (c) mode
2. A student's mean score on 4 quizzes was 6. If he scored 4, 5, 7 on three quizzes. What was his score on the fourth quiz?
3. If you have data on favourite subject for all students in your class, which measure of center would you use?
4. If the average height of a class is 61 inches and a very tall boy with height 65 inches joins the class, which measures of the center would change more-the mean or the median?
5. If you throw a fair die with 6 faces, what is the probability that it will show a
  - (a) 5
  - (b) 5 or 6
  - (c) 8
  - (d) an even number
6. In a bag, there are 4 red, 3 yellow, and 2 green balls. If you draw a ball at random, what is the probability of drawing
  - (a) a red ball
  - (b) a green ball
  - (c) a yellow ball
  - (d) a yellow or a green ball.
  - (e) a red or green or yellow ball
  - (f) a red and a green ball.

7. The bar graph given below gives the favourite TV programme of children of class VII



- (a) How many children prefer to watch cartoons?
  - b) How many children prefer to watch sports?
  - (c) Which kind of programme is most popular?
  - (d) Which kind of programme is least popular?
  - (e) How many more children prefer to watch serials than cartoons?
  - (f) How many children are in this class?
8. The data on marks in a mathematics test with maximum marks of 100 is given below:
- (a) How many students got marks between 30 and 39?
  - (b) How many students got marks between 20 and 29?
  - (c) How many students got marks below 40?
  - (d) How many students got 80 or more marks?



Marks	Number of students getting those marks
10 - 19	1
20 - 29	2
30 - 39	
40 - 49	5
50 - 59	6
60 - 69	5
70 - 79	4
80 - 89	4
90 - 99	3

### Project

Collect data from each student on topics such as their favourite sweet/favourite TV programme/favourite subject and whether the student is a boy or girl on a separate sheet of paper. Divide the class into groups and give to each group data on a topic and ask each group to

- Make a bar diagram, label the axes and give a title to the graph.
- A double bar graph that shows data for boys and girls, label the axes and give a title to the graph.

## Unit Test 4-Equations

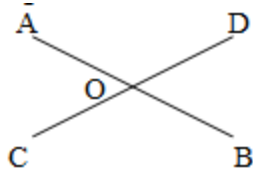
1. For the statements given below, write T against ones which are true for all values of  $x$  and F against ones which are true for only for specific values of  $x$ .
  - (a)  $x \times 0 = 0$
  - (b)  $2(x-1) = 2x - 2$
  - (c)  $x + 0 = 0$
  - (d)  $x + 10 = 0$
2. Solve the following equations
  - (a)  $2x - 8 = 4$
  - (b)  $3x + 5 = 11$
  - (c)  $7 + x = 5$
  - (d)  $2x - 5 = 7$
3. The sum of 2 consecutive natural numbers is 41. Find the numbers.
4. The sides of a triangle are in the ratio of 1:2:3. If its perimeter is 36 cm, find the sides.
5. In a lottery, a total of 200 prizes are to be given. A prize is either Rs. 500 or 100. Find the number of two prizes if the total prize money is Rs. 50,000.
6. 20% of a number is 7. Find the number.
7. Rani after spending three fourth of her pocket money has Rs. 5 left. How much was her pocket money?
8. I am thinking of a number, I double it and add 7 to it, I get 11. Find the number.
9. The ratio of girls to boys in a class is 4:5. If the total number of children in the class is 36. How many girls are in the class?

## Unit Test 5-Lines and Angles

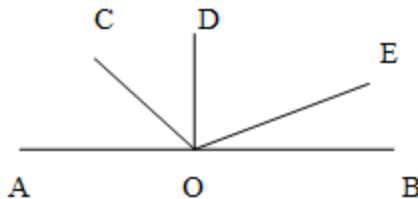
1. Draw a pair of angles which are

- (a) adjacent
- (b) complementary
- (c) supplementary

2. In the figure given below, lines AB and CD intersect at O name

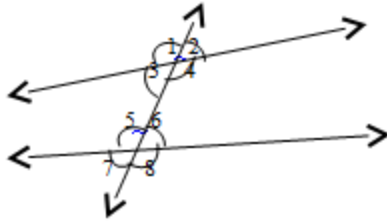


- (a) all pairs of supplementary angles
  - (b) all pairs of vertically opposite angles
  - (c) all pairs of adjacent angles
3. In the figure given below line DO is perpendicular to line AB name



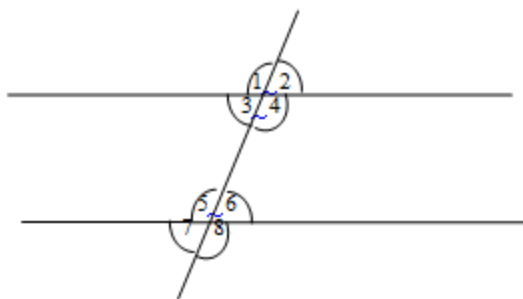
- (a) all pairs of adjacent angles
  - (b) all pairs of complementary angles
  - (c) all pairs of supplementary angles.
4. Draw a pair of angles on a geo /graph paper which are
- (a) adjacent
  - (b) complementary
  - (c) supplementary

5. In the figure given below, name a



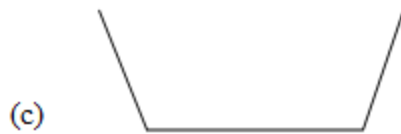
- (a) transversal.
  - (b) pair of corresponding angles.
  - (c) pair of alternate interior angles.
  - (d) pair of alternate exterior angles.
6. For the statements given below write T for true and F for false.
- (a) If two lines are intersected (cut) by a transversal the corresponding angles are equal.
  - (b) If a transversal intersects two lines and alternate interior angles are equal, the lines are parallel.
  - (c) If two lines are perpendicular to the same line, they are parallel.
  - (d) If two lines are intersected by a transversal, then alternate interior angles are equal.
7. In the figure given below a transversal cuts two parallel lines. If  $\angle 2 = 70^\circ$ , find the measures of
- (a)  $\angle 1$
  - (b)  $\angle 4$
  - (c)  $\angle 6$

(d)  $\angle 3$

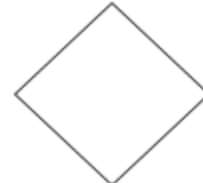
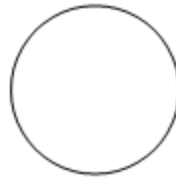
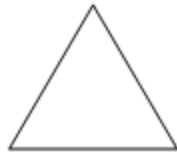


## Unit Test 6-Properties of Triangles

1. Draw a triangle and name it.
2. What property in the figures given below is lacking to prevent its being called a triangle-write it against them

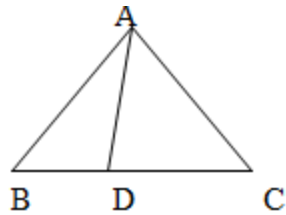


3. Which of the following are triangles?



4. The students had given the following as examples of triangular things. Which of these are wrong and why?
  - (a) samosa
  - (b) set square
  - (c) an open compasses
5. Draw a  $\triangle ABC$  and mark a point
  - (a) P in the interior of the  $\triangle$ .
  - (b) Q in the exterior of the  $\triangle$ .
  - (c) R on the  $\triangle$ .

6. Name all the triangles in the figures given below?



7. Two angles of a triangle are  $70^\circ$  and  $60^\circ$ . Find the third angle.

8. Angles of a triangle are in the ratio of 1:2:3, find all the angles.

9. Can you draw the triangles in which

(a)  $AB = 6$  cm,  $BC = 5$  cm and  $CA = 4$  cm

(b)  $AB = 8$  cm,  $BC = 4$  cm and  $CA = 3$  cm

(c)  $\angle A = 40^\circ$ ,  $\angle B = 60^\circ$  and  $\angle C = 70^\circ$

(d)  $\angle A = 70^\circ$ ,  $\angle B = 90^\circ$  and  $\angle C = 90^\circ$

If no, which property of a triangle is being violated?

10. Draw a triangle which is

(a) acute

(b) obtuse

(c) right

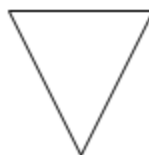
11. Draw an isosceles triangle. Explain your procedure.

12. In a right triangle,  $AB = 4$  cm,  $AC = 3$  cm and  $\angle A = 90^\circ$ . Find the length of side BC.

13. Classify the following triangles as scalene, isosceles or equilateral by writing S, I or E under them. If more than one of these apply, write all of them.



(a)

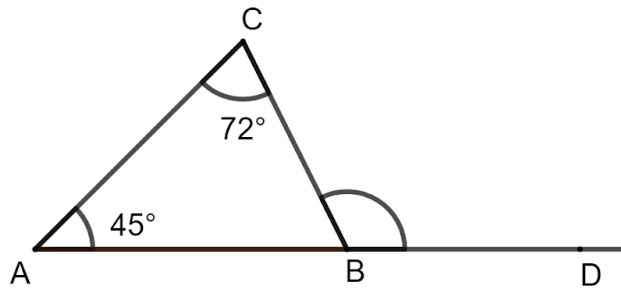


(b)



(c)

14. D is a point on AB produced, find  $\angle CBD$



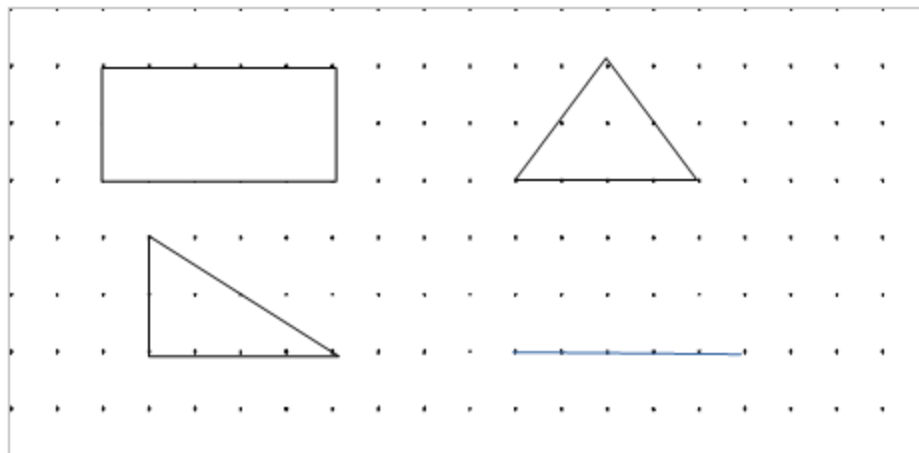
### Take-Home

1. Draw a triangle ABC and measure all its sides and angles and verify the following:
  - (a)  $\angle A + \angle B + \angle C = 180^\circ$
  - (b) exterior angle  $\angle C = \angle A + \angle B$
  - (c) the sum of lengths of any two sides is greater than the third.
2. With the help of a scale and protractor draw a triangle ABC whose angles and sides are given below.
  - (a)  $AB = 6 \text{ cm}$ ,  $\angle A = 60^\circ$ ,  $\angle B = 80^\circ$
  - (b)  $AB = 8 \text{ cm}$ ,  $BC = 4 \text{ cm}$  and  $\angle B = 65^\circ$ .
  - (c)  $AB = 5 \text{ cm}$ ,  $AC = 4 \text{ cm}$  and  $\angle A = 54^\circ$ .
3. Demonstrate sum of angles of a triangle = 2 right angles by drawing 3 triangles and cutting the triangles and tearing off their angles and arranging two angles adjacent to arms of the third angle.
4. Take toothpicks or matchsticks. Can you make  $\Delta$ s whose sides are as given below. If not explain why?
  - (a) 2 matchsticks, 3 matchsticks, and 4 matchsticks
  - (b) 2 matchsticks, 2 matchsticks, and 4 matchsticks
  - (c) 1 matchstick, 2 matchsticks, and 4 matchsticks
5. Draw an isosceles  $\Delta$  on a graph/dot paper and measure its angles. Verify that angles opposite the equal sides are equal.

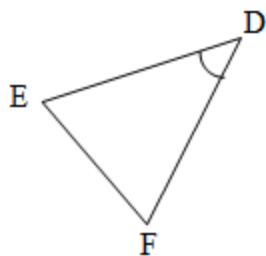


## Unit Test 7-Congruence of Triangles

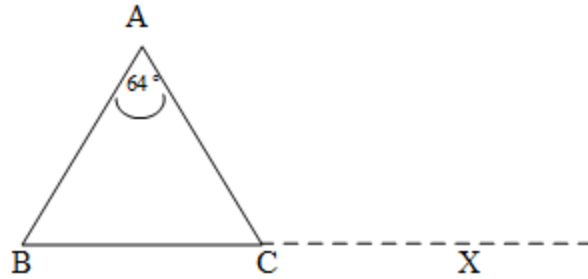
1. Draw the figures on a dot paper congruent to the figures given below:



2. DEF is isosceles  $\triangle$  with  $DE = DF$  and  $\angle D = 44^\circ$ , find  
 (a)  $\angle E$   
 (b)  $\angle F$



3. In the figure given below.  $AB = AC$  and X is a point on BC produced and  $\angle A = 64^\circ$ . Find



- (a)  $\angle ABC$
  - (b)  $\angle ACX$
4. The hypotenuse of a right-angled triangle is 13 cm. If one of the sides is 12 cm, find the third side.
5. Fill in the blanks:
- (a) A point joining the midpoint of a side of a  $\Delta$  to the opposite vertex is called a \_\_\_\_\_.
  - (b) A line segment passing through a vertex of a  $\Delta$  perpendicular to the line containing the opposite side is called a \_\_\_\_\_.
6. Which of the following sets of triangles ABC and DEF are congruent?
- (a)  $AB = DE$ ,  $AC = DF$  and  $BC = EF$
  - (b)  $AB = DE$ ,  $BC = EF$  and  $\angle A = \angle D$
  - (c)  $BC = EF$ ,  $CA = FD$  and  $\angle C = \angle F$
  - (d)  $\angle A = \angle D$ ,  $\angle B = \angle E$  and  $\angle C = \angle F$

## Unit Test 8-Percentage and Ratio

1. Find
  - (a) 5% of 150.
  - (b)  $\frac{1}{2}$  % of 1,000.
  - (c) 120% of 300.
2. Convert the following fractions into percentage:
  - (a)  $\frac{3}{4}$
  - (b)  $1\frac{1}{4}$
  - (c)  $\frac{23}{100}$
  - (d)  $1\frac{3}{100}$
3. Convert the following decimals into percentage
  - (a) 0.5
  - (b) 0.72
  - (c) 0.04
  - (d) 1.2
4. Find the number if
  - (a) 25% of the number is 40.
  - (b) 120% of the number is 60.
5. Sunil bought a horse for Rs 10,000. He sold it after a year at a loss of 6%.
  - (a) How much money did he lose?
  - (b) What price did he get for the horse?
6. A shopkeeper is giving a 20% discount. If you bought a shirt whose price was marked Rs. 80.
  - (a) How much discount will you get?
  - (b) How much money will you have to pay for the shirt?
7. You paid Rs.125 for a shirt that was 30% off. What was the original price of the shirt?
8. Ahmad deposited Rs 2,000 in a bank at the rate of 7% per annum simple interest. How much interest will he get after-two years?

9. Describe a situation in daily life in which you would need to make calculations given below
- (a) 10% of Rs. 1000
  - (b) 20% of Rs. 120
10. A shopkeeper buys notebooks at Rs. 500 per 100 notebooks. At what price he should sell a notebook to make a profit of 20%.
11. Write the following as a ratio:
- (a) Daily wages of a labourer is half of the daily wage of a mason.
  - (b) The breadth of a rectangular field is two-third of its length.
12. Sushila earned Rs 40,000 in a year. She saved Rs 2000 that year. Find the ratio of her income to savings in simplest form.
13. Draw two squares whose areas are in the ratio of 4:9.
14. Find x in the following proportions.
- (a)  $6:3::x:9$
  - (b)  $9:6::6:x$
15. In a mixture, the weight of copper and zinc are in the ratio of 5:3. If the weight of zinc is 9 kg, find the weight of copper.
16. Ram and Shyam invested money in the ratio of 3:4 in a business. If their total investment was Rs. 35000. How much money was invested by Ram?
17. (a) 85% of 135 will be more/less than 135.  
(b) 150% of 80 will be more/less than 80.

### Take-Home

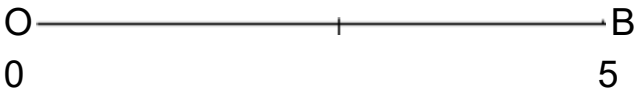
1. Give as many situations as possible in which a person needs to find a percentage.
2. In a restaurant, you are expected to pay 15% tip. If your bill was Rs.42.50. Estimate the tip you should pay. How did you figure it out?

3. Income tax in India for annual income up to 15,00,000 is charged according to the rules given below:

Annual Income	Income Tax
Up to Rs.2,50,000	Nil
Rs.2,50,000-Rs.5,00,000	5%
Rs.5,00,001-Rs.7,50,000	10%
Rs.7,50,001-Rs.10,00,000	15%

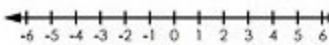
4. Find the income tax for a person in 2019-2020 whose taxable income is
- (a) Rs.2,30,000
  - (b) Rs.6,00,000
  - (c) Rs. 8,20,40
5. Give 3 situations in which a person would like to compare quantities by a ratio.

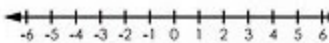
# Unit Test 9-Rational Numbers

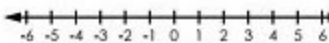
1. Define a rational number.
2. In  $\frac{-7}{10}$  write the
  - (a) numerator
  - (b) denominator
3. For the following numbers, write W against whole numbers, F against fractions, I against integers and R against rational numbers. If more than one of these is correct for a number write all of them
  - (a)  $-\frac{4}{5}$
  - (b)  $\frac{2}{3}$
  - (c) 5
  - (d) -7
4. What number is represented by A, if OB is 5 units and A is the mid-point of OB?
5. Represent the following numbers on a number line
  - (a)  $\frac{3}{4}$
  - (b)  $-\frac{2}{3}$
  - (c) -2
6. Write the following in the standard form
  - (a)  $\frac{9}{-15}$
  - (b)  $\frac{-8}{12}$
  - (c)  $\frac{-4}{-6}$
7. Compare the following numbers by writing  $>$ ,  $=$  or  $<$  for 
  - (a)  $\frac{1}{2}$    $\frac{2}{5}$
  - (b)  $-\frac{1}{2}$    $\frac{1}{3}$
  - (c)  $\frac{3}{6}$    $\frac{1}{2}$

8. For each set of numbers given below, give the number nearest to 1.
- (a)  $\frac{1}{2}$  ,  $\frac{3}{4}$  ,  $\frac{7}{8}$  ,  $\frac{11}{12}$
- (b)  $-\frac{1}{4}$  ,  $-\frac{2}{7}$  ,  $\frac{1}{5}$  ,  $\frac{1}{7}$
9. Without actual calculation, tell whether  $\frac{7}{8} \times 156$  would be greater or less than 156.
10. Write
- (a) two rational number between  $\frac{1}{2}$  and  $\frac{1}{3}$
- (b) one rational number between  $-\frac{1}{2}$  and  $-\frac{1}{4}$
- (c) three rational numbers between  $\frac{2}{3}$  and  $\frac{1}{3}$
11. Write the next two numbers of the number series given below
- (a)  $-\frac{9}{2}$  ,  $-\frac{7}{2}$  ,  $-\frac{5}{2}$  ,  $-\frac{3}{2}$  , \_\_\_\_\_ , \_\_\_\_\_
- (b)  $\frac{1}{2}$  ,  $\frac{2}{3}$  ,  $\frac{3}{4}$  ,  $\frac{4}{5}$  , \_\_\_\_\_ , \_\_\_\_\_
12. Write the opposite of
- (a)  $\frac{7}{4}$
- (b)  $\frac{-3}{8}$
13. Write the inverse of
- (a)  $-\frac{3}{4}$
- (b)  $\frac{5}{3}$
14. Simplify
- (a)  $\frac{1}{2} + (-\frac{3}{4})$
- (b)  $-\frac{1}{4} + (-\frac{2}{3})$
- (c)  $\frac{2}{3} - (\frac{3}{5})$
- (d)  $-\frac{7}{8} - (-\frac{3}{4})$
- (e)  $\frac{3}{5} \times (-\frac{2}{3})$
- (f)  $-\frac{4}{5} \times (\frac{5}{6})$
- (g)  $-\frac{2}{7} \div (\frac{5}{14})$
- (h)  $-\frac{1}{5} \div (-\frac{3}{10})$

15. Show the following on a number line

$$-3 + 7 = \underline{\hspace{2cm}}$$


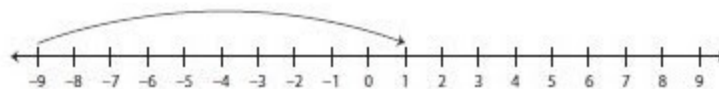
$$2 + [-5] = \underline{\hspace{2cm}}$$


$$-1 + [-2] = \underline{\hspace{2cm}}$$


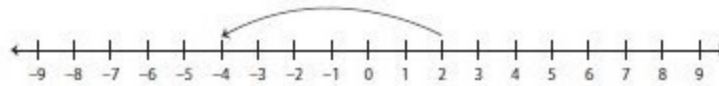
16. Write the number sentences for the subtraction of integers shown below on the number line.



$$\underline{\hspace{1cm}} - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$



$$\underline{\hspace{1cm}} - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$



$$\underline{\hspace{1cm}} - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$



$$\underline{\hspace{1cm}} - \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

17. State which property of rational numbers is being used in the following :

(a)  $\frac{1}{4} + \frac{2}{3} = \frac{2}{3} + \frac{1}{4}$

(b)  $-\frac{2}{3} \times \frac{3}{5} = \frac{3}{5} \times (-\frac{2}{3})$

(c)  $(\frac{1}{2} + \frac{4}{7}) + \frac{3}{7} = \frac{1}{2} + (\frac{4}{7} + \frac{3}{7})$

(d)  $\frac{1}{2} \times (3 - 5) = \frac{1}{2}(3) - \frac{1}{2} \times 5$

(e)  $\frac{2}{3} \times 0 = 0$

18. Simplify using a property of rational numbers that makes the calculations easier



(a)  $\frac{5}{8} + \frac{4}{7} + \frac{3}{8}$

(b)  $\frac{1}{3} \times \frac{11}{6} - \frac{1}{3} \times \frac{5}{6}$

19. Describes a situation in daily life for which the; following calculations would be needed:

(a)  $\frac{3}{4} + \frac{1}{4}$

(b)  $\frac{4}{5} - \frac{1}{2}$

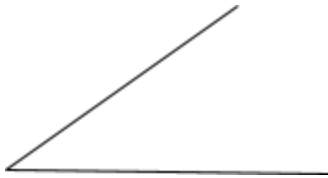
20. A tray can hold 6 glasses. How many trays are needed to serve 16 persons at the same time?
21. How many ribbons of length  $\frac{3}{5}$  metres can be made from 6 metres of ribbon?
22. A family cooks  $\frac{2}{3}$  kg of rice daily, how much rice should they buy for 15 days?
23. Write the next number of the number series given below:
- (a)  $\frac{2}{3}$  ,  $\frac{1}{3}$  , 0,  $-\frac{1}{3}$  , \_\_\_\_\_
- (b)  $\frac{1}{2}$  ,  $\frac{2}{3}$  ,  $\frac{3}{4}$  ,  $\frac{4}{5}$  , \_\_\_\_\_
24. Which fundamental operations are possible in rational numbers which were not always possible in
- (a) integers
- (b) fractions

## Unit Test 10-Constructions

1. Construct a line congruent to the line given below with the help of a compass and ruler. Describe your procedure.



2. Construct an angle equal to the angle given below with the help of a compass and ruler. Describe your procedure.



3. Draw a perpendicular at point P on the line AB. Describe your procedure.
4. Draw a line perpendicular to a line AB from a point P outside the line with the help of a compass and ruler B. Describe your procedure.
5. Draw a line through a point P outside a line AB parallel to line AB with the help of a compass and ruler. Describe your procedure.
6. Construct a  $\triangle ABC$  whose sides and/or angles are given below. If a  $\triangle$  cannot be constructed with these measures, explain why?

- |                          |                        |                       |
|--------------------------|------------------------|-----------------------|
| (a) $AB = 6 \text{ cm}$  | $BC = 5 \text{ cm}$    | $CA = 4 \text{ cm}$   |
| (b) $AB = 8 \text{ cm}$  | $BC = 4 \text{ cm}$    | $CA = 3 \text{ cm}$   |
| (c) $AB = 6 \text{ cm}$  | $\angle A = 70^\circ$  | $\angle B = 70^\circ$ |
| (d) $AB = 5 \text{ cm}$  | $\angle A = 120^\circ$ | $\angle B = 60^\circ$ |
| (e) $AB = 5 \text{ cm},$ | $BC = 5 \text{ cm}$    | $\angle C = 54^\circ$ |
| (f) $AB = 4 \text{ cm}$  | $BC = 6 \text{ cm}$    | $\angle C = 80^\circ$ |

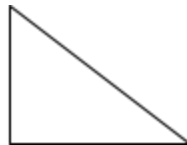
### Take-Home

1. Draw triangles ABC on a loose sheet, cut it and show by paper folding

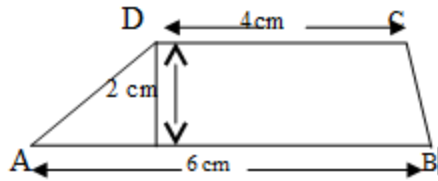
- (a) mid-point E of side AB
  - (b) angle bisector of  $\angle C$
  - (c) perpendicular from C to side AB
  - (d) perpendicular at E the midpoint of side AB.
2. Construct triangles using 3, 4, 5, 6, 7 toothpicks or matches. If you could construct a triangle name it. If you could not construct a triangle with specific numbers of matches explain why?

## Unit Test 11-Perimeter and Area

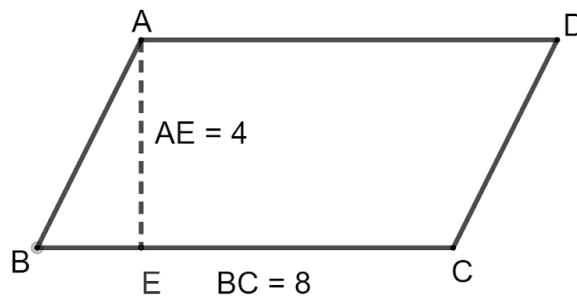
1. Give a situation in daily life in which determination of perimeter would be required.
2. Find the perimeter of a square whose side is 4 cm.
3. Find the perimeter of a rectangle whose length is 6 cm and width is 4 cm.
4. Draw on a dot or graph paper
  - (a) a square with a perimeter of 16 cm
  - (b) a rectangle with a perimeter of 18 cm
5. Give a situation in daily life in which determination of area would be required.
6. What is the circumference of a circle whose radius is 4 cm?
7. Fill in blanks
  - (a) 1 cm = \_\_\_\_\_mm
  - (b) 1 m = \_\_\_\_\_cm
  - (c) 3.4 cm = \_\_\_\_\_mm
  - (d) 4.2 m = \_\_\_\_\_cm
  - (e) 3.08 m = \_\_\_\_\_cm
8. Which units m, cm, or mm would you use for measuring perimeters and areas of the objects given below.
  - (a) a face of a matchbox
  - (b) a new pencil
  - (c) a garden
9. Find the area of a rectangle whose length is 6 cm and width is 4 cm.
10. Measure the sides of figures given below in cm and find their areas.



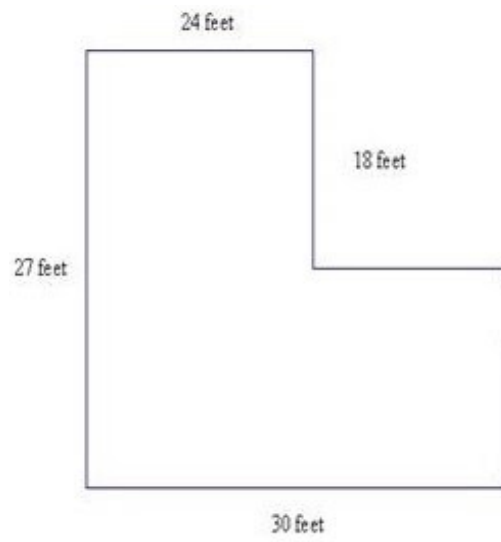
11. The area of a trapezium is given by  $\frac{1}{2}(a + b).h$  where  $a$  and  $b$  are the lengths of parallel sides and  $h$  is the distance between them. Find the area of trapezium given below.



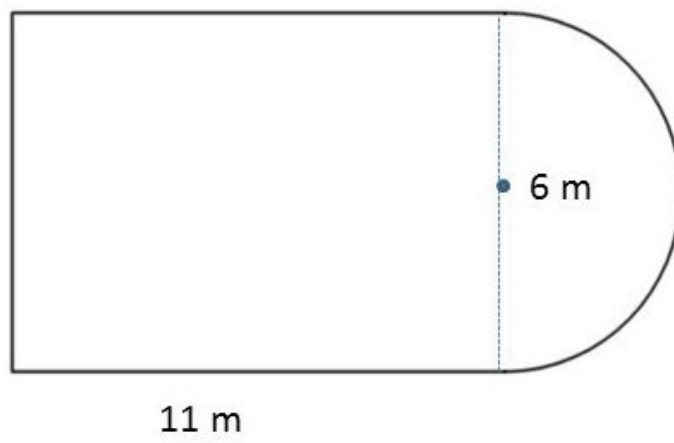
12. Find the area of a parallelogram given below.



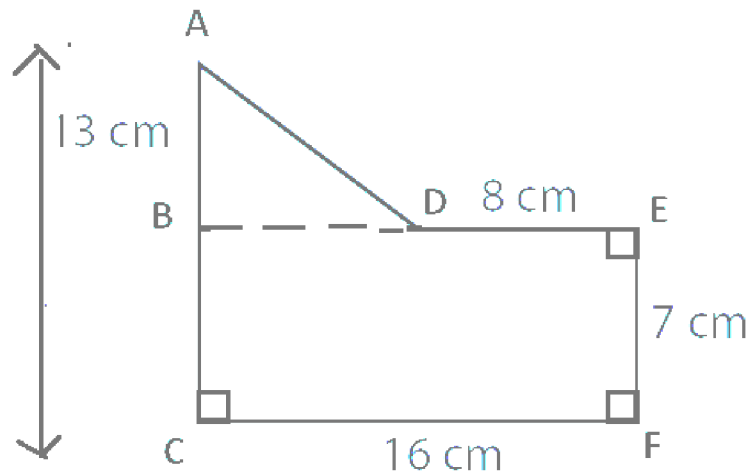
13. Find the area of a circle whose radius is 6 cm.
14. Find the area of a triangle whose base is 4.5 cm and height is 3.2 cm.
15. On a dot or graph draw a square whose area is 16 unit<sup>2</sup>
16. On a dot or graph paper draw a rectangle whose area is 12 unit<sup>2</sup>
17. On a dot or graph paper draw a triangle whose area is 8 unit<sup>2</sup>
18. A room is 4 metre long and 3.5 metre wide. Its floor is to be covered with square tiles with a side of 50 cm. How many tiles would be needed to cover the floor?
19. Find the areas of figures given below:



(a)



(b)



(c)

1. Take-Home  
Find the area of following using a graph paper.
  - (a) a leaf
  - (b) a circular object
2. Trace a circular object in your house, find its centre and area. Describe your procedure.
3. Draw a triangle, find its height and area. Describe your procedure.
4. Draw a parallelogram, find its height and area. Describe your procedure.
5. Draw a trapezium, find its height and area. Describe your procedure.

## Unit Test 12-Algebra

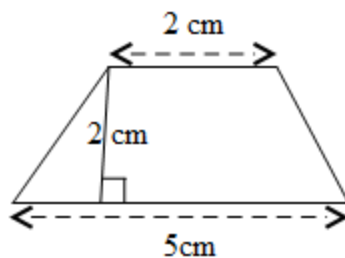
1. Write all terms in the expression  $a^2 + 2ab + 4$ .
2. Write the coefficient of  $x$  in
  - (a)  $5x$ .
  - (b)  $x$ .
3. Write the constant term in  $4x + 7y + 5$ .
4. Which of the following pairs represents like terms? Select all of them.
  - ☐  $3x, 7x$
  - ☐  $4y, -5y$
  - ☐  $4x, 4y$
  - ☐  $4ab, -7ab$
  - ☐  $xy, xy^2$
  - ☐  $x, x^2$
  - ☐  $xyz, zyx$
5. Add
  - (a)  $2x$  and  $3x$
  - (b)  $x$  and  $8x$
  - (c)  $3y$  and  $-7y$
  - (d)  $a + 2b$   
 $2a - b$
  - (e)  $3a + 2b + 3c$   
 $4a + b - 4c$
  - (f)  $2a + 2b + 3c$   
 $a - b - 7c$
6. Simplify
  - (a)  $5a - 3a$
  - (b)  $4a - (-7a + b)$
  - (c)  $b - 3b + 4$
  - (d)  $(4x + 4xy + 3) - (2 + xy)$
7. Classify the following algebraic expressions as monomial binomial or trinomial



- (a)  $4xy$
  - (b)  $xyz$
  - (c)  $4a + 2y$
  - (d)  $3xy + 7y + 2$
8. Simplify
- (a)  $7x + 2(2x-2y)$
  - (b)  $4x + 3y-(x-2y)$
  - (c)  $5x + [7x-(4x-3)]$
9. Write the last two terms in brackets with a - sign before the bracket without changing expressions given below.
- (a)  $4x + 6y-2x-3y$
  - (b)  $4 + 3z - 2z + 5$
10. Evaluate the following for  $a = 2$  and  $b = 3$ :
- (a)  $4a$
  - (b)  $ab$
  - (c)  $b^2$
  - (d)  $(-a)^3$
11. For the following series write (i) the next term and (ii)  $n^{\text{th}}$  term.
- (a) 2, 4, 6, 8...
  - (b) 1, 4, 9, 16...
  - (c) 5, 9, 13, 17...
11. Find the following products
- (a)  $6 \times 2a$
  - (b)  $3y(4y + 3)$
  - (c)  $(x + 5)(x - 5)$
  - (d)  $(2x + 3y)(-3x + 7y)$
  - (e)  $(y^2 + 2xy + 6)(2x + 3y)$
12. Find the value of
- (a)  $6bc$  for  $a=1$ ,  $b=2$ ,  $c=4$
  - (b)  $(5b) \times (6a + b + c)$  for  $a = 1$ ,  $b = 2$ ,  $c = 5$ .

13. The area of a trapezium is given by  $\frac{1}{2} (a + b)h$  where  $a$  and  $b$  are the lengths of parallel sides of a trapezium and  $h$  is the distance between them.

Find the area of the trapezium given below:



## Unit Test 13-Exponents and Powers

1. In  $4^3$  name the
  - (a) base
  - (b) exponent
2. Express the exponents given below as repeated multiplication of a number
  - (a)  $2^4$
  - (b)  $(-5)^3$
3. Express the repeated multiplications given below as an exponent of the number.
  - (a)  $\frac{1}{4} \times \frac{1}{4} \times \frac{1}{4}$
  - (b)  $(-\frac{3}{4}) \times (-\frac{3}{4}) \times (-\frac{3}{4}) \times (-\frac{3}{4})$
4. Express in power notation
  - (a)  $\frac{1}{8}$
  - (b)  $\frac{8}{27}$
  - (c)  $(\frac{3}{4})^3 \times (\frac{3}{4})^2$
  - (d)  $(\frac{5}{8})^7 \div (\frac{5}{8})$
  - (e)  $(\frac{3}{4})^5 \times (\frac{4}{3})^5$
  - (f)  $7^0$
5. Find the reciprocal of numbers given below in exponential form
  - (a)  $(-3)^4$
  - (b)  $(\frac{1}{2})^3$
6. Fill in the blanks
  - (a)  $3^4 \times 3^5 = 3^{\quad}$
  - (b)  $(\frac{4}{7})^3 \times (\frac{4}{7})^2 = (\frac{4}{7})^{\quad}$
  - (c)  $(\frac{3}{4})^4 \times (\frac{3}{4})^{-2} = (\frac{3}{4})^{\quad}$
  - (d)  $3^4 \div 3^2 = 3^{\quad}$
  - (e)  $\frac{1}{2^7} = 2^{\quad}$

$$(f) \left(\frac{3}{7}\right)^4 \div \left(\frac{3}{7}\right)^8 = \left(\frac{3}{7}\right)^{\text{---}}$$

$$(g) \frac{2^7}{2^5} = 2^{\text{---}}$$

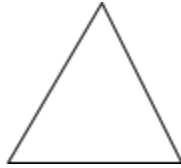
7. Is  $(a + b)^3 = a^3 + b^3$  where  $a$  and  $b$  are rational numbers? If not, give a counterexample.
8. Express the following numbers in scientific notation:
  - (a) 5,00,000
  - (b) 4,23,758
  - (c) 483.75
  - (d) 0.0032
  - (e) 0.0000052
9. Express the following in decimal notation:
  - (a)  $6 \times 10^6$
  - (b)  $4.63 \times 10^7$
  - (c)  $5.78 \times 10^{-5}$
10. Express the following statements in scientific notation:
  - (a) The distance of the Moon from the Earth is 384,000,000 m.
  - (b) The diameter of the Earth is 1,27,56,000 m.
  - (c) A human blood cell is about 0.000008 metre in diameter.
11. Give situations in day-to-day life in which you need to find powers of a number.

## Unit Test 14-Symmetry

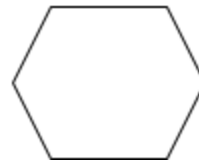
- Name 3 objects that are symmetrical.
- State the number of lines of symmetry in the figures given below.



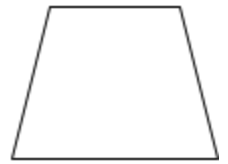
(a)



(b)

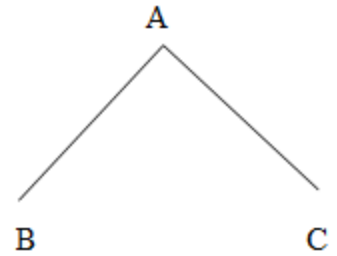
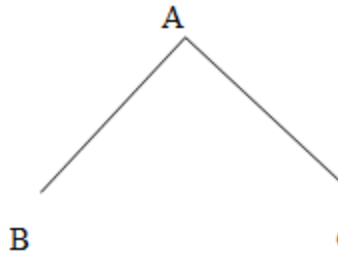
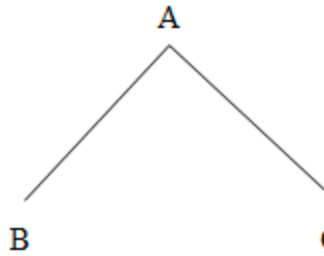


(c)



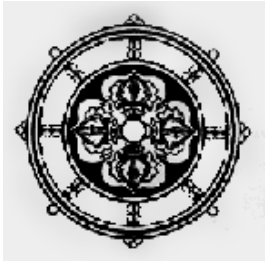
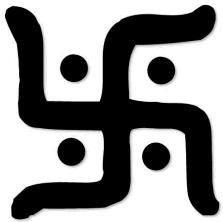
(d)

- In all the figures given below  $AB = AC$  and  $m\angle A = 90^\circ$ . Complete the three figures so that a figure has
  - no line of symmetry
  - one line of symmetry
  - four lines of symmetry

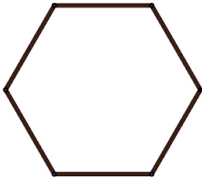


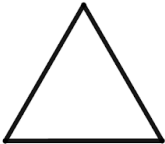
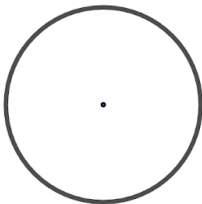

- Fill in the following table for line symmetry and rotational symmetry of the letters or logos given below:

Letter or logo	Number of lines of symmetry	Order of rotational symmetry
M		
N		
O		
B		

H		
		
		

5. For the letters or designs given below, fill in the following table for the line symmetry and rotational symmetry of the letters given below

Shape	Number of lines of symmetry	Order of rotational symmetry
		

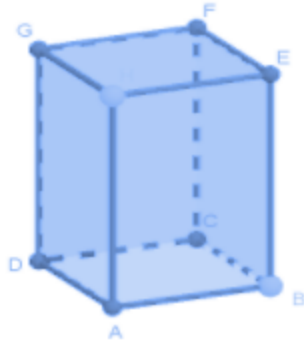
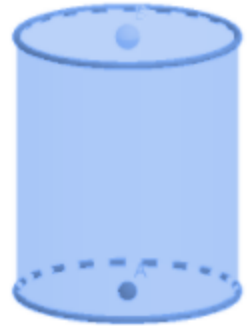
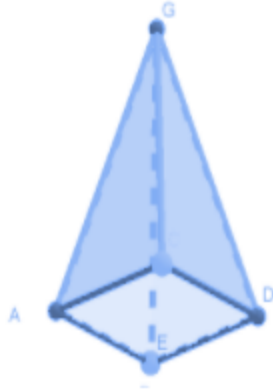
		
		
		

### Take Home

1. Draw a  $\triangle ABC$  with  $BC = 5\text{cm}$ ,  $AB = AC = 6.5\text{ cm}$  on a loose sheet. Draw a perpendicular  $AD$  from  $A$  to  $BC$  cut the  $\triangle ABC$ . Show by paper folding that  $AD$  is a line of symmetry of the  $\triangle$ .
2. Collect pictures of objects in your environment which have rotational or line symmetry.
3. Draw three different geometrical shapes which have no lines of symmetry.

## Unit Test 15-Three Dimensional Shapes

1. Name the solids given below:

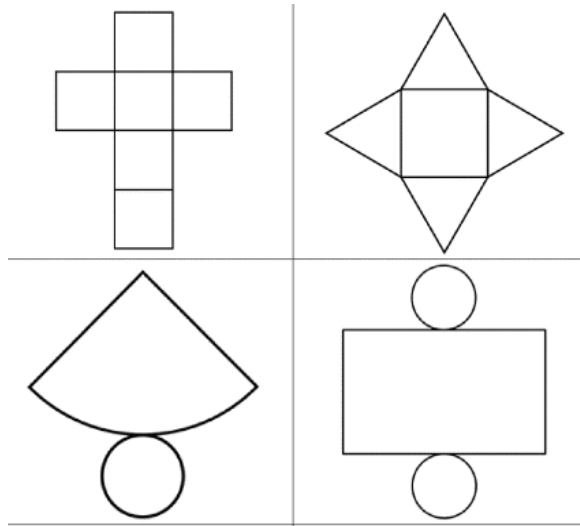


2. On an isometric grid or triangular dot paper draw the following:

- (a) A cube whose side is 3 units.
- (b) A rectangular prism whose length, width, and height are 5 cm, 4 cm, and 3 cm respectively.
- (c) A square pyramid with a side 2 cm and height of 3 cm.

3. For each net, name the solid it will make.





4. Find the number of faces, edges, and vertices of the solids given below.

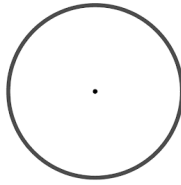
Name of the solid	Number of Faces F	Number of Edges E	Number of Vertices V
Cube			
Cuboid			
Hexagonal Prism			
Cylinder			
Cone			

5. Name the solids which have the following cross-sections. If there is more than one solid, that has one of these cross-sections,

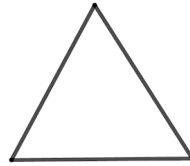
name all of them.



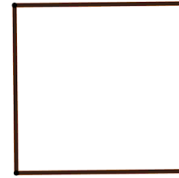
(a)



(b)



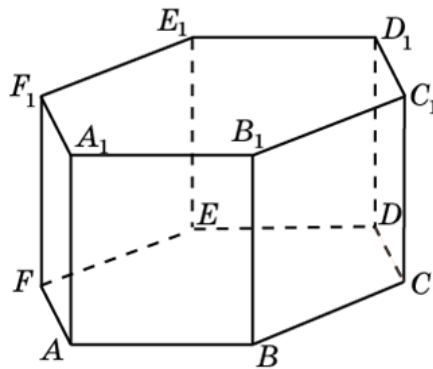
(c)



(d)

6. For the prism given below, name an example for each of the following:

- (a) a face.
- (b) an edge.
- (c) a corner.
- (d) a pair of parallel planes.
- (e) a pair of parallel line segments.



7. Name the shape of the cross-sections of the following polyhedrons when cut by a plane parallel to the base.

- (a) A rectangular prism
- (b) A cylinder.
- (c) A square pyramid.
- (d) A triangular prism.
- (e) A pentagonal pyramid.
- (f) A tetrahedron.

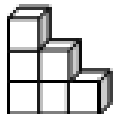
8. Name the shape of the following solids when cut by a plane perpendicular to the base.

- (a) A rectangular pyramid.
- (b) A cylinder.
- (c) A cone
- (d) A triangular prism.
- (e) A square pyramid.

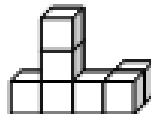
9. Give the front, side and top view of the solids given below:



(a)

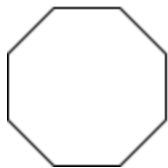


(b)



(c)

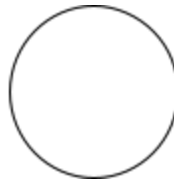
10. Name as many solids as you can that have one or more faces given below:



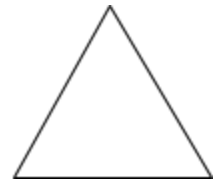
(a)



(b)



(c)



(d)

11. I am a 3-D shape, all my faces are squares, who am I?

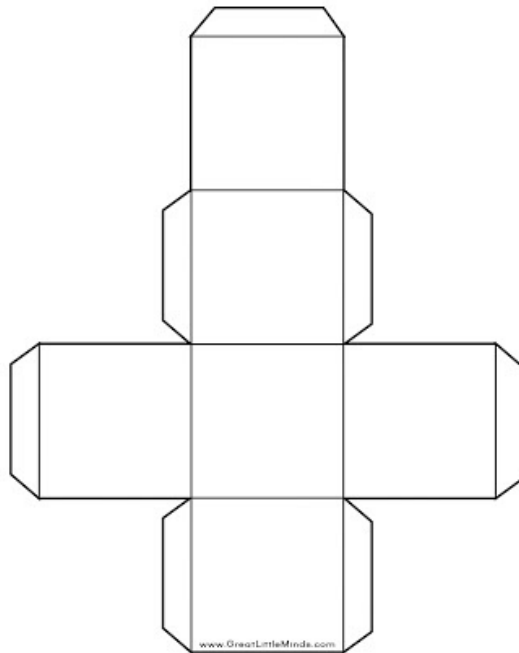
### Take-Home

1. Make the following with plasticine and cut them horizontally, name the shape of faces you have:

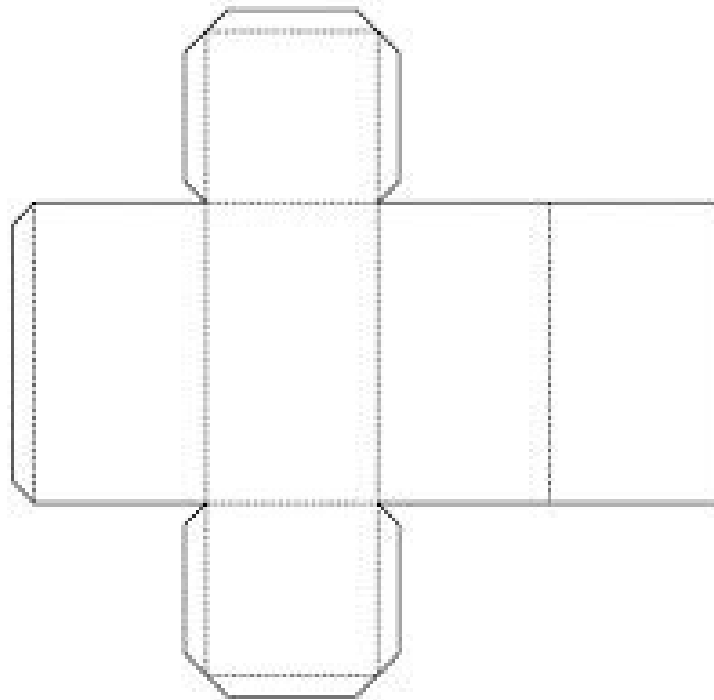
- (a) a cube
- (b) a sphere
- (c) a tetrahedron.

2. Make the following with plasticine and cut them vertically, name the faces you have:  
(a) a cuboid                      (b) a cone                      (c) a square polyhedron
3. What makes a shadow?
4. Take a small shiny object like a new penny, a cube, a pink eraser or a marble and drop the shiny object somewhere about 4-5 feet from you in any direction. Next, find your own shadows. Make an O sign with your fingers, so that your shadows show a little ring or circle for your hands. Can you, without squatting, move your shadow ring so that it encircles the shiny object on the ground? Observe where the Sun was when you were able to do it Where was the object when it worked? (The sun should be behind your hand and the object directly in front of our hand.)
5. Nets for a cuboid, cone and cylinder are given below. Trace, cut and paste on thin cardboard and fold these to make a cuboid, cone and cylinder and describe them.

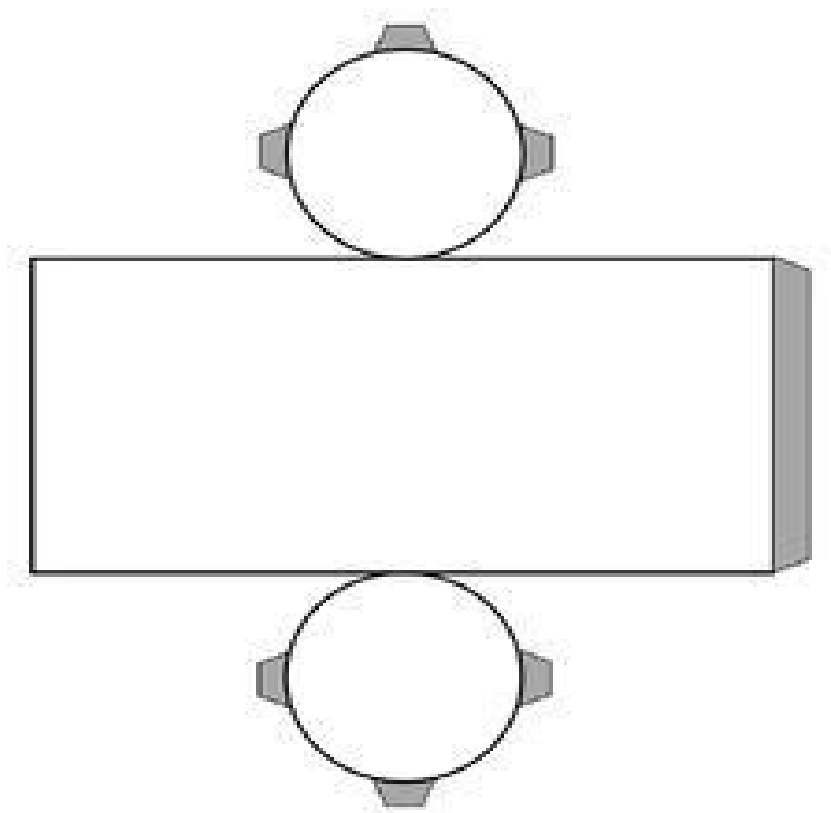
Net for a cube



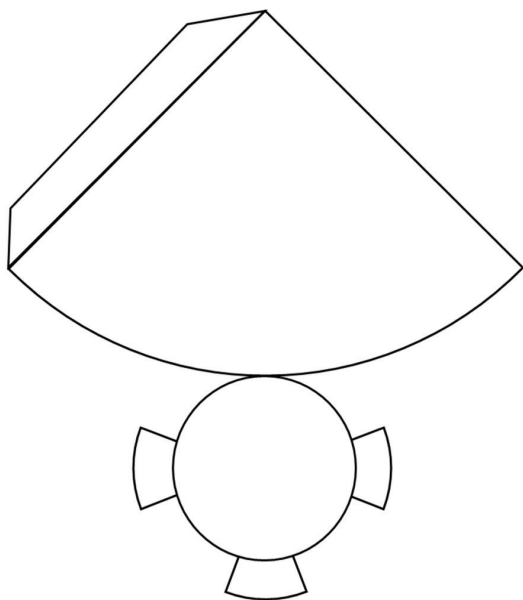
## Net for a Cuboid



Net for a Cylinder



Net for a Cone




## Criterion Test for Class 7

Item Number	Objective	Item
1	Knowledge	Simplify (a) $-8 \div 4$ (b) $-7 \times (-4)$
2	Understanding	Fill in the blanks (a) $\underline{\hspace{1cm}} \times (-2) = 10$ (b) $(-7) \times 5 = 5 \times \underline{\hspace{1cm}}$
3	Knowledge	Express $\frac{4}{5}$ as a decimal number.
4	Knowledge	Simplify (a) $\frac{3}{5} \times \frac{1}{2}$ (b) $\frac{1}{4} \div \frac{2}{7}$
5	Application	If the price of a dollar is Rs. 47, how many dollars can you buy in Rs.1000? (1 dollar = 100 cents.)
6	Application	A sweet maker bought 20 kg of milk; he used 5.25 litres of milk for Burfee and 8.5 litres of milk for Rasgullas. How much milk is left?
7	Transfer	a and b are whole numbers and $a > b$ , Write the proper inequality in $\frac{1}{a} \square \frac{1}{b}$
8	Application	Daily wage of a mason is Rs.100 more than the daily wage of a labourer. If the wage of a



		mason is Rs.400, what is the wage of a labourer?
9	Knowledge	Write 60 paise per 3 rupees in simplest form.
10	Application	Draw two line segments AB and CD whose lengths are in the ratio of 3:5.
11	Application	A shopkeeper sold a shirt for Rs. 300 and made a profit of 20%. What was the cost price of the shirt?
12	Knowledge	Simplify $\frac{1}{2} p^2 q(p+2q)$
13	Understanding	Find the value of $103 \times 97$ using the special product.
14	Understanding	Which of the following is true for only a specific value of x. Encircle it.  A. $2x-2 = 2(x-1)$  B. $3x+2 = 5$  C. $(x+2)^2 = x^2 + 4x + 4$  D. $(x-3)^2 = x^2 - 6x + 9$
15	Knowledge	Solve the following equation:  $\frac{2}{3}x + 1 = \frac{4}{3}$
16	Application	Students of a class decided to hire a minibus to go to a fair. They have to pay Rs. 4 each for the bus. But 4 students could not go and they had to pay Rs 5 each. Write an

		equation to find N the number of students in the class.
17	Understanding	If a and b are whole numbers and $a > b$ , then write the proper inequality in $-a \square -b$
18	Application	Give 3 examples of triangles from your environment.
19	Knowledge	Draw an obtuse triangle.
20	Understanding	Which of the triangles given below are congruent? (a) All triangles whose angles are $40^\circ$ , $50^\circ$ , and $90^\circ$ . (b) All triangles whose three sides are 4 cm, 5 cm, and 3 cm.
21	Knowledge	With the help of a scale and compasses draw an angle equal to the angle given below: 
22	Knowledge	With the help of a scale and compass draw a line parallel to the line passing through A and B from a point P outside it.
23	Knowledge	With the help of a scale and compass draw a line parallel to a line from a point P outside it.

24	Knowledge	Construct a triangle whose sides are 4 cm, 5 cm and 7 cm.
25	Knowledge	Draw a circle and a chord in it that is not a diameter.
26	Understanding	Draw net of a cube on a graph paper
27	Knowledge	Find the area of a triangle whose base is 5 cm and height is 3 cm.
28	Understanding	Draw a rectangle whose perimeter is 24 cm.
29	Application	In a circular roundabout of radius 3 metres there is a path around it of width $\frac{1}{3}$ metres. Find the area of the path?
30	Transfer	Draw two parallelograms having the same area on graph paper.

31	Knowledge	<p>The data on marks in a English test with maximum marks of 100 is given below:</p> <p>(a) How many students got marks below 40?</p> <p>(b) How many students got 80 or more than 80 marks?</p> <table><tr><th>Marks</th><th>Number of students with marks in that interval</th></tr><tr><td>30 - 39</td><td>6</td></tr><tr><td>40 - 49</td><td>8</td></tr><tr><td>50 - 59</td><td>4</td></tr><tr><td>60 - 69</td><td>7</td></tr><tr><td>70 - 79</td><td>4</td></tr><tr><td>80 - 89</td><td>3</td></tr></table>	Marks	Number of students with marks in that interval	30 - 39	6	40 - 49	8	50 - 59	4	60 - 69	7	70 - 79	4	80 - 89	3
Marks	Number of students with marks in that interval															
30 - 39	6															
40 - 49	8															
50 - 59	4															
60 - 69	7															
70 - 79	4															
80 - 89	3															
32	Knowledge	<p>The scores of 10 students in a music competition are given below. Find the median of the scores.</p> <p>4, 6, 8, 5, 7, 6, 9, 3, 6, 5</p>														
33	Understanding	<p>Can we represent the same data by a pictograph and a bar diagram?</p>														

## TESTS FOR CLASS VIII

### Unit Test 1-Rational Numbers

1. For the following numbers, write W against whole numbers, F against fractions, I against integers, and R against rational numbers. More than one of these may be correct for a number write all of them
  - (a)  $-\frac{4}{5}$
  - (b)  $\frac{2}{3}$
  - (c) 5
  - (d) -7
2. Represent the following numbers on a number line
  - (a)  $1\frac{3}{4}$
  - (b)  $-\frac{2}{3}$
  - (c) -2
3. Write the following in the standard form
  - (a)  $\frac{9}{-15}$
  - (b)  $\frac{-8}{12}$
  - (c)  $\frac{-4}{-6}$
4. Compare the following numbers by writing  $>$ ,  $=$  or  $<$  between them
  - (a)  $\frac{1}{2}$  \_\_\_\_\_  $\frac{2}{5}$
  - (b)  $-\frac{1}{2}$  \_\_\_\_\_  $\frac{1}{3}$
  - (c)  $\frac{3}{6}$  \_\_\_\_\_  $\frac{1}{2}$
5. Write
  - (a) two rational number between  $\frac{1}{2}$  and  $\frac{1}{3}$
  - (b) one rational number between  $-\frac{1}{2}$  and  $-\frac{1}{4}$
  - (c) three rational numbers between  $\frac{2}{3}$  and  $\frac{1}{3}$
6. Simplify
  - (a)  $\frac{1}{2} + (-\frac{3}{4})$

$$(b) -\frac{1}{4} + (-\frac{2}{3})$$

$$(c) \frac{2}{3} - (\frac{3}{5})$$

$$(d) -\frac{7}{8} - (-\frac{3}{4})$$

$$(e) \frac{3}{5} \times (-\frac{2}{3})$$

$$(f) -\frac{4}{5} \times (\frac{5}{6})$$

$$(g) -\frac{2}{7} \div (\frac{5}{14})$$

$$(h) -\frac{1}{5} \div (-\frac{3}{10})$$

7. Are rational numbers closed under

(a) addition?

(b) subtraction?

(c) multiplication?

(d) division?

8. State which property of rational numbers is being used in the following :

$$(a) \frac{1}{4} + \frac{2}{3} = \frac{2}{3} + \frac{1}{4}$$

$$(b) -\frac{2}{3} \times \frac{3}{5} = \frac{3}{5} \times (-\frac{2}{3})$$

$$(c) (\frac{1}{2} + \frac{4}{7}) + \frac{3}{7} = \frac{1}{2} + (\frac{4}{7} + \frac{3}{7})$$

$$(d) \frac{1}{2} \times (3 - 5) = \frac{1}{2} (3) - \frac{1}{2} \times 5$$

$$(e) \frac{2}{3} \times 0 = 0$$

9. Fill in the blanks using properties of rational numbers:

$$(a) \frac{3}{4} + (-\frac{1}{2}) = \text{-----} + \frac{3}{4}$$

$$(b) \frac{5}{7} + \text{-----} = \frac{5}{7}$$

$$(c) \frac{3}{4} + \text{-----} = 0$$

$$(d) \frac{2}{3} + \frac{4}{7} + \frac{1}{3} = \frac{2}{3} + \frac{1}{3} + \text{-----}$$

$$(e) -\frac{6}{7} \times \text{-----} = -\frac{6}{7}$$

$$(f) \frac{4}{5} \times \text{-----} = 1$$

$$(g) \frac{1}{5} (\frac{3}{4} + \frac{1}{2}) = \frac{1}{5} (\frac{3}{4} + \text{-----})$$

$$(h) \frac{1}{2} \times \frac{5}{8} \times 2 = \frac{1}{2} \times 2 \times \text{-----}$$

## Unit Test 2-Linear Equations in One Variable

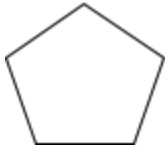
1. Which of the following are true for only some values of  $x$ ? Select all that apply.
  - ☐  $(x + a)(x + b) = x^2 + (a + b)x + ab$
  - ☐  $2x + 3 = 8$
  - ☐  $x^2 = 25$
  - ☐  $(x-3)(x-2) = 0$
2. Solve
  - (a)  $2x + 3 = 3x - 1$
  - (b)  $3x + 3 = 5(3-x)$
  - (c)  $\frac{y}{4} = 8$
  - (d)  $\frac{3}{4}x = 8$
  - (e)  $\frac{3y-7}{2y} = 4$
  - (f)  $\frac{2x-3}{3x-4} = \frac{2}{3}$
3. Find  $x$ , if  $6:x::3:4$ .
4. A scooter charges Rs. 5 for the first mile and Rs.2.10 for each additional mile.
  - (a) Write an expression for the cost of traveling  $x$  miles.
  - (b) Draw its graph.
5. A taxi service A charges Rs. 10 for the first kilometre and Rs. 8 per mile for additional miles and the taxi service B charges Rs. 9 per mile. Which taxi is cheaper if you have to go to a place 5 miles from your house?
6. The perimeter of a parallelogram is 50 cm. If its width is 6 inches less than its length. Write an expression for finding the width of the parallelogram.
7. The sum of two numbers is 30 and their ratio is 2:3. Find the numbers.
8. 20 percent of a number is 7. Find the number.
9. If the side of a square is increased by 10%. Find the percentage increase in its
  - (a) perimeter
  - (b) area
10. The sides of a rectangular field are in the ratio 2:3. Find the sides of the rectangular field if its perimeter is 40 metres.

11. There are 70 chickens and goats in a barn which have 200 legs. Find the number of chickens and goats.
12. The sum of two consecutive numbers is 41. Find the numbers.
13. Two trains leave the city at the same time, one going east and the other going west. If one train is traveling at 63 miles per hour and the other at 59 miles per hour. In how many hours they will be 822 miles apart?



## Unit Test 3-Quadrilaterals

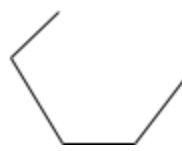
1. What property prevents the following from being called a quadrilateral?



(a)



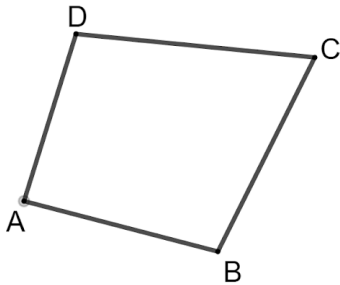
(b)



(c)

2. For the quadrilateral given below, name

- (a) its sides
- (b) its angles
- (c) a pair of opposite sides
- (d) a pair of adjacent sides



3. Draw a rectangle on a cm graph or geo paper whose adjacent sides are 8 cm and 6 cm
4. Draw a square, on a cm graph or geo paper whose side is 5 cm
5. Construct a parallelogram whose side are 6 cm and 9 cm and the angle included between a pair of adjacent sides is  $70^\circ$ .
6. Some quadrilaterals are given below, under each write Q for a quadrilateral P for a parallelogram, R for a rectangle, Rh for a Rhombus, and S for a square. You may use more than one symbol under each.



(a)



(b)



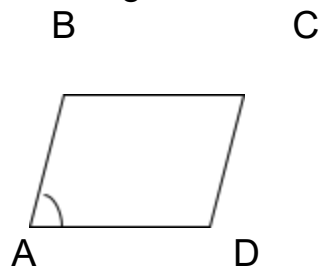
(c)



(d)

7. The adjacent sides of a parallelogram are 6 cm and 8 cm. Find its perimeter.

8. In the parallelogram,  $\angle A = 70^\circ$ , Find

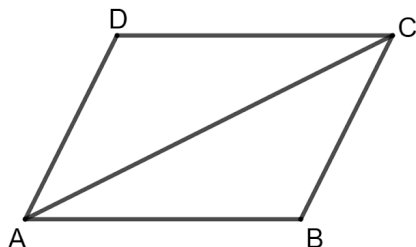


- (a)  $\angle B$ ,
- (b)  $\angle C$
- (c)  $\angle D$

9. The angles of a quadrilateral are in the ratio of 1:2:3:4. Find all angles of the quadrilateral.

10. ABCD is a parallelogram. Give reasons for the following:

- (a)  $\angle CAD = \angle ACB$
- (b)  $\angle BCA = \angle DAC$
- (c)  $\triangle ABC \cong \triangle CDA$



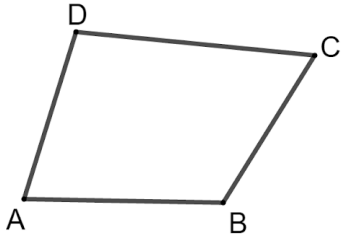
### Take-Home

1. Demonstrate by cutting angles of quadrilaterals and placing them next to each other that the sum of angles of a quadrilateral is equal to four right angles.
2. Draw the following figure, cut them. Explore properties for each of the figures of its angles, sides, diagonals by observation, paper folding, measuring, and note them. Cut it along the diagonal, and check if the two triangles formed by cutting it are congruent:
  - (a) a rectangle
  - (b) a square
  - (c) a rhombus
  - (d) a parallelogram

3. Name the quadrilaterals that satisfy the following properties. If more than one quadrilateral satisfies it, name all of them. Draw each of these on a graph or geo paper.
- (a) One pair of opposite sides are parallel.
  - (b) Both pairs of opposite sides are parallel.
  - (c) Both pairs of opposite sides parallel and all angles are congruent.
  - (d) All sides are congruent.
  - (e) All sides and all angles are congruent.

## Unit Test 4-Constructions

1. Construct a quadrilateral congruent to the quadrilateral given below.  
Write steps of construction



2. Some measures of sides and/or angles of a quadrilateral are given below. For each of these if a unique quadrilateral is possible, construct it. If the information is not sufficient to construct a unique quadrilateral, write N.
- (a)  $AB = 4\text{cm}$ ,  $BC = 7\text{cm}$ ,  $AD = 3\text{cm}$ ,  $\angle B = 60^\circ$ ,  $CD = 6\text{cm}$
  - (b)  $AB = BC = 3\text{cm}$ ,  $AD = CD = 5\text{cm}$  and  $\angle ABC = 120^\circ$
  - (c)  $AB = 3.6\text{cm}$ ,  $BC = 5.5\text{cm}$ ,  $CD = 5\text{cm}$ ,  $\angle D = 83^\circ$  and  $\angle C = 80^\circ$
  - (d)  $AB = 3.5\text{cm}$ ,  $AC = 4.5\text{cm}$ ,  $AD = 5\text{cm}$  and  $\angle ABC = \angle ACD = 90^\circ$
  - (e)  $AB = 3.5\text{cm}$ ,  $BC = 6\text{cm}$ ,  $\angle A = \angle B = 105^\circ$  and  $\angle D = 150^\circ$
  - (f)  $BC = 4\text{cm}$ ,  $CA = AD = 5.5\text{cm}$ ,  $CD = 5\text{cm}$  and  $BD = 7\text{cm}$
  - (g)  $AB = 6\text{cm}$ ,  $BC = 4\text{cm}$ ,  $CD = 7\text{cm}$  and  $DA = 5\text{cm}$
  - (h)  $AB = 5\text{cm}$ ,  $BC = 4\text{cm}$ ,  $CA = 10\text{cm}$ ,  $CD = 5\text{cm}$  and  $AD = 7\text{cm}$
  - (i)  $AB = 5.5\text{cm}$ ,  $BC = 3.7\text{cm}$ ,  $\angle A = 60^\circ$ ,  $\angle B = 105^\circ$  and  $\angle D = 90^\circ$ .

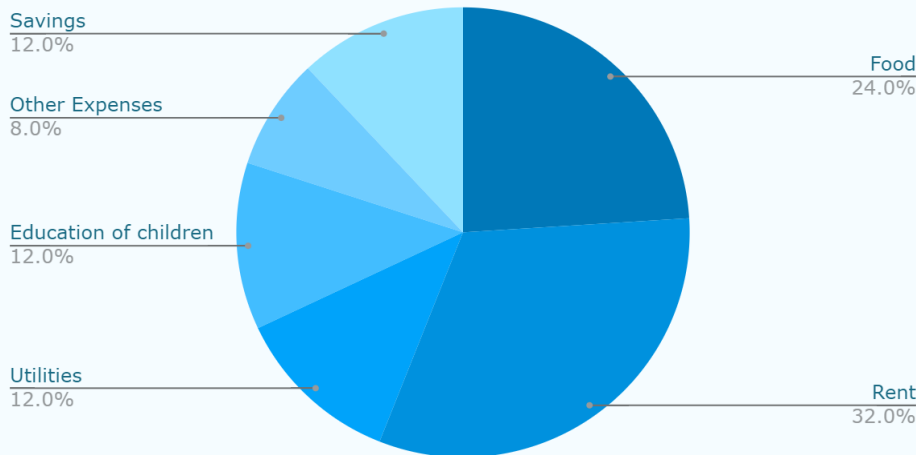
## Unit Test 5-Data Handling

1. For the set of data 8, 5, 2, 5, 4, find the
  - (a) mean
  - (b) median
  - (c) range
2. The scores of 30 students in a Mathematics Test are summarized in the frequency distribution given below:

Score	Frequency
20-29	1
30-39	4
40-49	4
50-59	6
60-69	9
70-79	5
80-89	0
90-100	1

3.
  - (a) How many students obtained between 40 and 50 marks
  - (b) How many students scored above 70 marks
  - (c) How many students scored less than 40 marks
  - (d) What is the class size
  - (e) Draw a histogram to represent this data
4. The number of children in families of 20 students in a class was 2, 3, 4, 1, 4, 5, 3, 3, 2, 1, 1, 4, 7, 3, 2, 2, 3, 4, 5 and 1
  - (a) Make a frequency distribution showing the number of families having different number of children.
  - (b) Draw a bar graph to represent this data.
  - (c) What is the mode of the distribution?
5. The pie chart given below shows the amount a family with an income of Rs. 25,000 spends on different items.

Money Spent by a Family with an Income of 25,000 on Different Items



- (a) How much does it spend on food?
  - (b) How much does it spend on rent and utilities?
  - (c) On which item does it spend the maximum amount?
6. The time spent by a child on different activities is given below:
- Sleeping-8 hours
  - School-6 hours
  - Home work-2 hours
  - Play-2 hours
  - TV-2 hours
  - Others-4 hours
- Draw a pie-chart for the time spent by the child on different activities.
7. A box contains 4 red balls, 2 blue balls, and 3 white balls. A ball is randomly chosen from the box. What is the probability that
- (a) a blue ball is chosen.
  - (b) a red or white ball is chosen
  - (c) a white ball is not chosen
8. A six face die with numbers 1-6 is thrown, what is the probability, that the number shown is:
- (a) 5
  - (b) 8
  - (c) an odd number
  - (d) a number greater than 1
9. If a cricket team has won the toss in the first two matches, what is the probability of its winning the toss in the third match?

## Take-Home

**Project 1**-Select appropriate units for collecting data on any of the following from your classmates their height, weight, time they watched TV last Sunday, score in an examination etc. and then collect data from all your classmates.

- (a) Find its range and mean using a calculator.
- (b) Make a grouped frequency distribution with 8-10 classes.
- (c) Draw a graph to represent it.
- (d) Describe it.

**Project 2**- Note down to the nearest half hour the time you spent on a week day in school including travel time, play, home work, watching TV, chores and other activities, make a pie chart of that and describe it.

**Project 3**-Describe an experiment in which different outcomes have an equal chance of occurring.

Experiment with it 30 times and make a frequency distribution of different outcomes.

Experiment with it 60 times and write the frequency of different outcomes.

What do you notice?

## Unit Test 6-Squares and Squareroots

1. Find the square root of the following numbers

(a) 9

(b) 400

(c)  $\frac{25}{81}$

(d) 0.16

2. Area of a square is  $81 \text{ cm}^2$ , find its side.

3. Using the patterns below, fill in the blanks in the last row

$$1 = 1 = 1^2$$

$$1 + 3 = 4 = 2^2$$

$$1 + 3 + 5 = 9 = 3^2$$

$$1 + 3 + 5 + 7 = 16 = 4^2$$

$$1 + 3 + 5 + 7 + 9 = 25 = 5^2$$

$$1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

4. Using the patterns below, fill in the blanks in the last row

$1^2 =$	1							
$11^2 =$	1	2	1					
$111^2 =$	1	2	3	2	1			
$1111^2 =$	1	2	3	4	3	2	1	
$11111^2 =$	<u>    </u>	<u>    </u>	<u>    </u>	<u>    </u>	<u>    </u>	<u>    </u>	<u>    </u>	<u>    </u>

5. Find the smallest number by which 200 must be multiplied to become a perfect square.

6. Between which whole numbers  $\sqrt{69}$  will lie?

7. Between which decimal numbers  $\sqrt{0.03}$  will lie?

8. Estimate the square root of the following correct to two decimal places.

(a) 2

(b) 71

9. Illustrate the following laws by using specific numbers:

$$\sqrt{ab} = \sqrt{a} \times \sqrt{b}$$

$$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$$



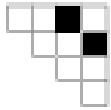
10. Give a situation in which you would need to find a
  - (a) square of a number
  - (b) square root of a number
11. Find the smallest number which must be subtracted from 200 to make it a perfect square.
12. A student found the square root of 337.615 by a calculator to be 58.10. Without actual calculation explain why his answer is not reasonable?
13. If two sides of a right angled triangle are 5 cm and 6 cm, find the hypotenuse correct to the nearest millimetre.
14. The product of two numbers is 64. One of them is four times the other. Find the numbers.
15. The hypotenuse of a right angled triangle is 10 cm and one of its sides is 6 cm, find the other side.
16. Draw a right angled triangle on a graph or dot paper whose hypotenuse is
  - (a)  $\sqrt{2}$
  - (b)  $\sqrt{17}$

## Unit Test 7-Cubes and Cube Roots

1. Give a situation in which you would need to find
  - (a) Cube of a number.
  - (b) Cube root of a number.
2. Find the cube root of the following:
  - (a) 64
  - (b) 216
3. What is the smallest number by which the following should be multiplied so that the product is a perfect cube:
  - (a) 49
  - (b) 72
4. Find the smallest number by which the following should be divided so that the product is a perfect cube:
  - (a) 16
  - (b) 432
5. Find the cube root of
  - (a) -8
  - (b)  $-\frac{27}{64}$
  - (c) 0.027
6. Between which whole numbers  $\sqrt[3]{20}$  will lie?
7. Illustrate by using specific numbers:
$$\sqrt[3]{\frac{a}{b}} = \frac{\sqrt[3]{a}}{\sqrt[3]{b}}$$
8. A student using a calculator found the cube root of 10 to be 4.648. Explain why her answer is unreasonable?
9. The volume of a cube is 8 cm. Find its side.
10. The side of a cubic box is 3 cm if its side is increased by 2 cm, what would be the increase in its volume?
11. I am a two digit number, a multiple of 11. I am not odd, the product of my digits is a perfect square as well as a perfect cube. What number am I?

## Unit Test 8-Comparing Quantities

1. Monika deposited Rs.5000 in a bank at 10% simple annual interest. How much interest she would get after 2 years.
2. Banks pay 8% interest per annum for a deposit of 46 days or more up to a year. If Sunita deposits Rs. 5,000 for 80 days. Write an expression for interest she would earn. You need not simplify it.
3. Sushila earned Rs 40,000 in a year. She saved Rs 2000 that year. Find the ratio of her income to savings.
4. What percent of the following diagram is shaded black?



5. A man sold a car for Rs 1,80,000 and incurred a loss of Rs 35,000. What was the cost price of the car?
6. A vegetable vendor bought 30 kg onions for Rs.360, if he wants to make a profit of Rs.60 on these, what selling price per kg he should fix for onions.
7. Raman bought a TV worth Rs.12,000 and also had to pay a VAT of 12.5%. How much money did he pay for the TV?
8. A shopkeeper is giving a 20% discount on ready made clothes. If you paid Rs. 200 for it. What was its original price?
9. Cost of a bicycle depreciates 10% every year. Find the cost of a bicycle after two years whose present value is Rs.1,800.
10. Mohamad made a fixed deposit of Rs. 5,000 for two years at 10 % interest compounded annually. What amount he would get on maturity of the deposit.
11. Indra Vikas Patras double in eight years. Write an equation to find the rate of interest, if it is compounded annually.
12. Amit got a 15% raise in his salary. If his salary now is 50,000. Find his salary before he got the raise.
13. The bacteria in a lab was increasing at the rate of 2% per hour. If it is now 2000, what would be its count after 4 hours?

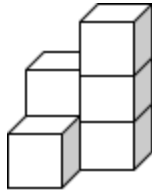
## Unit Test 9- Algebraic Expressions and Identities

1. Write all the terms in  $a^2 + 2ab + 4c$
2. Write the coefficient of  $x$  in
  - (a)  $7x$
  - (b)  $x$
3. Which of the following pairs represents like terms? Check all that apply
  - ☐  $3x, 7x$
  - ☐  $4y, -5y$
  - ☐  $4x, 4y$
  - ☐  $4ab, -7ab$
  - ☐  $x^2, 2x$
  - ☐  $2a^2, 5ba^2$
  - ☐  $xyz, zyx$
4. Classify the following as monomial, binomial and trinomial:
  - (a)  $4xy + 4$
  - (b)  $3 + x^2y - 7xy$
  - (c)  $8y^2z$
5. Add
  - (a)  $x$  and  $8x$
  - (b)  $3y$  and  $-7y$
  - (c)  $(a + 2b + 3c)$  and  $(4a - 3b + 2)$
6. Subtract
  - (a)  $5a$  from  $3a$
  - (b)  $4a$  from  $-7a$
  - (c)  $2x^2 + xy$  from  $4x^2 + 4xy + 2$
  - (d)  $2a + b^2$  from  $3a^2 + 4ab - 4b^2$
7. Find the product of terms given below:
  - (a)  $1 \times y$
  - (b)  $(3x) \times (5x)$
  - (c)  $(2yx) \times y$
  - (d)  $6x \times (2x - 3)$
  - (e)  $(x + 7)(x - 2)$
  - (f)  $(2x + 3)(3x + 5)$

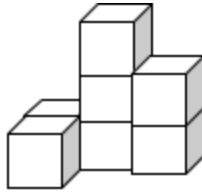
8. Find the value of
  - (a)  $6a^2bc$  for  $a=1$ ,  $b=2$ ,  $c=4$ .
  - (b)  $(5a^2b)(6abc)$  for  $a = 1$ ,  $b = 2$ ,  $c = 3$ .
9. Find the following products using identities or special products.
  - (a)  $(y + 4)(y + 3)$
  - (b)  $(x + 2)(x - 2)$
  - (d)  $(2a + 3b)(2a - 3b)$
  - (e)  $(5a + 6)^2$
  - (g)  $(2x - 5)^2$
10. Evaluate the following using special products
  - (a)  $102 \times 103$
  - (b)  $104 \times 96$
  - (c)  $53 \times 53$
11. If  $x + 1/x = 3$ , find  $x^2 + 1/x^2$
12. Divide
  - (a)  $8xy^2$  by  $2xy$
  - (b)  $x^2 - y^2$  by  $(x + y)$
  - (c)  $x^2 + 5x + 6$  by  $x + 2$
  - (d)  $4y^2 + 8y + 3$  by  $(2y + 1)$
  - (e)  $14x^2 + 13x - 12$  by  $7x - 4$

## Unit Test 10-Visualizing 3-D Shapes

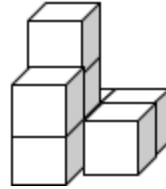
1. Draw the top, front and side view of a cone.
2. Draw the top, front and side view of structures made with blocks whose pictures are given below:



(a)

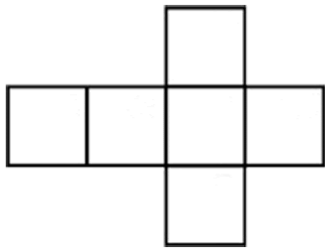


(b)

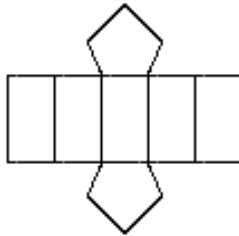


(c)

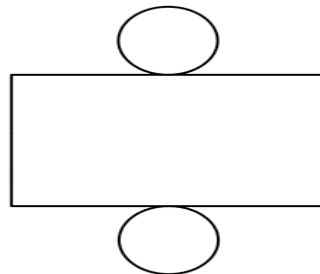
3. Some nets are shown below. Name the solids that we can make by folding them



(a)



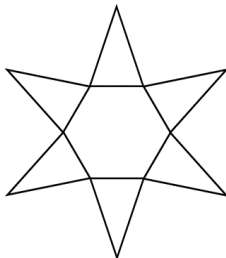
(b)



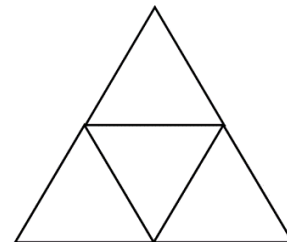
(c)



(d)



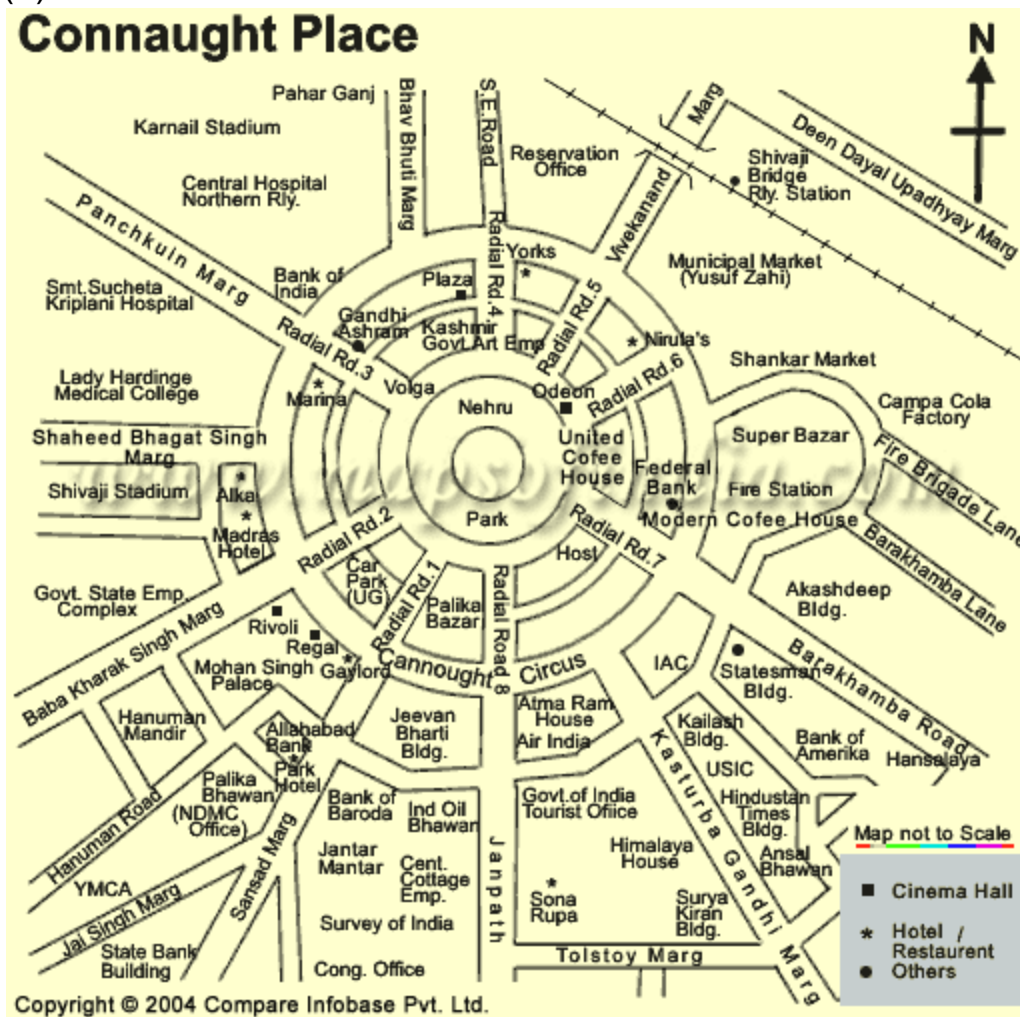
(e)



(f)

4. Describe the shapes of faces, number of faces, edges and corners of the following solids:
  - (a) a cylinder
  - (b) a rectangular prism or cuboid
  - (c) a square pyramid
  - (d) a tetrahedron
  - (e) a sphere

1. (a) How are a cylinder and prism alike?  
(b) How are a cone and pyramid alike?
2. (a) Give directions for going to the school canteen from your classroom.  
(b) Give directions for going to the Principal's office from your classroom.
3. Map of Rajiv Chowk Area is given below:  
(a) Give direction for going from Barakhamba Road to Palika Bazar  
(b) Nehru Park to Shankar Market.



## Take-Home

1. What information would you need to draw a map of your school to a proper scale? Collect it with the help of your classmates and draw a map of your school.

2. What information would you need to draw a map of your house to a proper scale? Collect it and draw the map of your house.



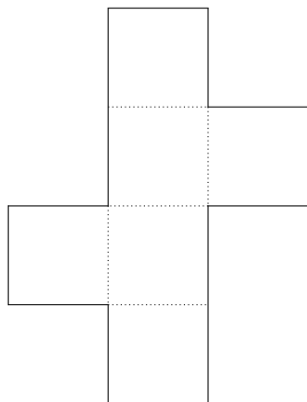
## Unit Test 11 Mensuration

1. Fill in the blanks :
  - (a) 1 metre = .....cm
  - (b) 1 km = .....metres
  - (c) 1cm = .....mm
  - (d)  $1 \text{ km}^2 = \dots\dots\dots\text{m}^2$
2. Find the area of a rhombus whose diagonals are 8 cm and 6 cm
3. Find the base of a triangle whose area is 12 cm and altitude is 4 cm
4. The parallel sides of a trapezium are 10 cm and 8 cm and the distance between them is 12 cm, find the area of the trapezium.
5. Find the area of a right  $\Delta$  whose sides are 6 cm, 8 cm and 10 cm
6. Draw shapes given below on a cm graph paper with areas shown against them. If you can draw many of them with this area, draw two of those.
  - (a) a rhombus with area equal to  $20 \text{ cm}^2$
  - (b) a trapezium with area equal to  $24 \text{ cm}^2$
  - (c) a parallelogram with area equal to  $18 \text{ cm}^2$
7. Construct a rhombus whose perimeter is 20 cm. Describe your procedure.
8. Give examples of a cuboid in the environment.
9. Is a cube a cuboid?
10. Draw a figure of a cuboid on a dot or graph paper. Name all its vertices, edges, and faces.
11. State all the properties of a
  - (a) cuboid
  - (b) cube
12. Give an example from daily life in which you would need to determine
  - (a) volume of a cuboid
  - (b) surface area of a cuboid
13. Fill in blanks
  - (a) 1millimetre =..... $\text{cm}^3$
  - (b) 1litre =..... $\text{cm}^3$
14. A tea cup would hold about
  - A. 2 ml
  - B. 20 ml
  - C. 200 ml

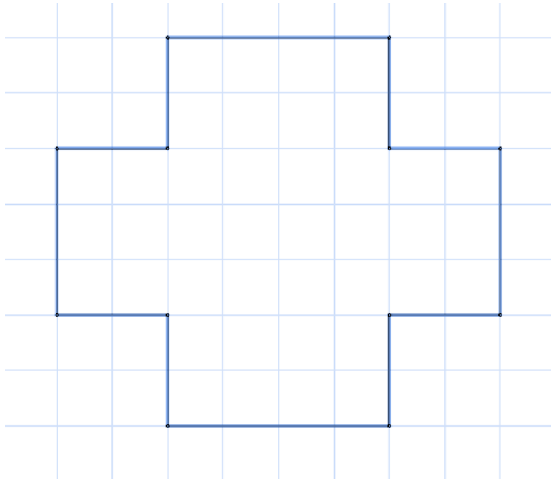
15. How many cubes with side 1 cm will be needed to fill a cuboid box with length 7 cm, height 1 cm and breadth 4 cm
16. If sides of two cubes are in the ratio of 1:2, find the ratio of their volumes.
17. A match box measures 4 cm  $\times$  2.5 cm  $\times$  1.5 cm. A packet contains 10 such match boxes. What will be the volume of the packet?

### Take-Home

1. For a match box. identify its
  - (a) faces
  - (b) edges
  - (c) vertices
2. Find the number of faces, edges and corners of a match box. What are the shapes of its faces?
3. Take any container in the shape of a cuboid or rectangular prism-a box for sweets, shoes etc.
  - (a) Measures its dimensions
  - (b) Find its volume
  - (c) Find its surface area
4. A net of a cube is given below. If you cut the net of a cube and fold it along a dotted line. You will get a cube. Draw another net and verify by making a cube.



5. Cut the edges of the grid given below, glue it to a thin cardboard and make a topless box. Find its
- (a) dimensions.
  - (b) surface area.
  - (c) volume.



6. Find the volume of irregular objects by using water displacement and a measuring cup.
7. Give examples from daily life when you would need to estimate surface area of a
- (a) cube.
  - (b) cuboid.
  - (c) right circular cylinder.
8. Take a 100 cm thin wire or rope and use it to explore the area of different rectangles, square, parallelogram enclosed by it. Which shape encloses the maximum area?
9. Mark a grid on a graph paper from which an open box of size  $5 \times 4 \times 4$  can be made (taking a square as a unit) and make it by gluing it to a thin cardboard.
10. Using thick paper make a model for a right circular cylinder. Find its
- (a) height and radius
  - (b) surface area
  - (c) volume

## Unit Test 12-Exponents and Powers

1. Express the following in exponential form

(a)  $\sqrt{7}$

(b)  $\sqrt[3]{10}$

2. Express the following as radicals

(a)  $10^{\frac{1}{2}}$

(b)  $64^{\frac{1}{3}}$

3. Simplify

(a)  $(\frac{1}{2})^2$

(b)  $(5)^{-3}$

(c)  $(\frac{3}{4})^3 \times (\frac{3}{4})^2$

(d)  $(\frac{1}{3})^2 \div (\frac{1}{3})$

4. Fill in the blanks:

(a)  $3^2 \times 3^3 = 3^{\text{---}}$

(b)  $8^7 \div 8^5 = 8^{\text{---}}$

(c)  $(\frac{4}{5})^9 = \text{---} \times (\frac{4}{5})^3$

(d)  $(\frac{3}{7})^4 = (\frac{3}{7})^6 \div \text{---}$

5. Find m if

(a)  $2^m = 8$

(b)  $7^3 \times 7^m = 1$

(c)  $2^m = 16$

(d)  $(\frac{3}{7})^4 \times \text{---} = 1$

## Unit Test 13-Direct and Inverse Proportion

1. Fill in blanks

(a) If  $x = ky$  two quantities  $x$  and  $y$  are said to vary .....

(b) If  $xy = k$  two quantities  $x$  and  $y$  are said to vary .....

2. Find the relation between  $x$  and  $y$  in the following tables and state whether the variables are directly or inversely related.

(a)

$x$	7	9	13	21
$y$	21	27	39	63

(b)

$x$	1	1.5	2.0	2.5
$y$	1	1.5	2.0	2.5

(c)

$x$	1	2	3	4
$y$	12	6	4	3

(d)

$x$	1	2	3	4
$y$	2	1	$\frac{2}{3}$	$\frac{1}{2}$

3. Check all the variables that vary inversely?

☐ The speed of a car and time taken to cover a certain distance.

☐ The speed of a car and distance covered in a fixed time.

☐ Numbers of persons hired to complete the work and time taken to finish it.

☐ The number of similar towels hanging in sunshine and time taken to dry them.

4. Give examples of a variables which vary:

(a) directly

(b) inversely

5. At an average speed of 60 km per hour a train from New Delhi reaches Ambala in 4 hrs. 20 minutes. How far is Ambala from New Delhi?

6. If 12 labourers can dig a Road in 4 days. How many labourers should be employed to finish it in 3 days?
7. A person wants to donate a certain amount of money equally to some temples. If he donates it to ten temples each will get 150 rupees. How much money would each get if the same amount is donated to 15 temples
8. For a given mass of gas, volume varies inversely with pressure. If volume is 60 at an atmospheric pressure of  $\frac{3}{2}$ . Find the pressure when volume is 48.
9. A 500 metres long train crosses a pole in 25 seconds. What is the speed of the train in km/hr?
10. The cost of 5 kg of rice is 150 rupees. what would be the cost of  $2\frac{1}{2}$  kg?

## Unit Test 14–Factorisation

1. Divide

- (a)  $3x^2 + 4x$  by  $x$
- (b)  $10x - 25$  by  $2x - 5$
- (c)  $8x^2y + 8xy^2$  by  $2xy$

2. Factorize the following

- (a)  $5ab - 3b$
- (b)  $m^2 + 12m + 36$
- (c)  $x^4 - y^4$
- (d)  $4m^2 - 16m + 16$
- (e)  $m^2 + 5m + 6$

3. If  $x + \frac{1}{x} = 3$ , find the value of  $x^2 + \frac{1}{x^2}$

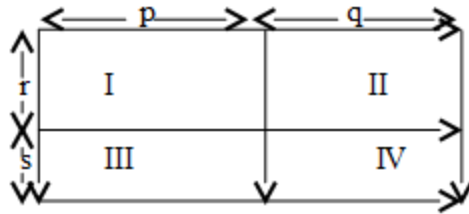
4. Divide

- (a)  $a^2 - b^2$  by  $a - b$
- (b)  $a^2 + 6ab + 9b^2$  by  $a + 3b$
- (c)  $4a^2 - 4ab + b^2$  by  $2a - b$
- (d)  $x^2 + 7x + 12$  by  $x + 4$

5. Show by drawing a square on line segment of length  $a + b$  and partitioning it that

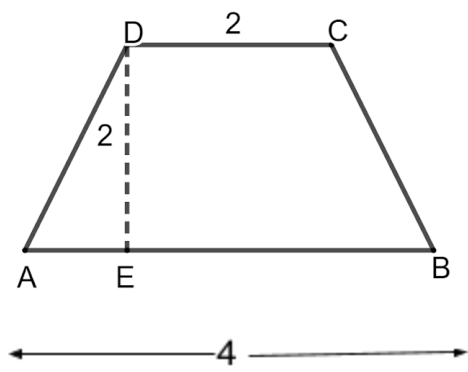
$$(a + b)^2 = a^2 + 2ab + b^2$$

6. In the figure given below, write the appropriate expression against the areas represented by rectangles marked as



- (a) I
- (b) IV
- (c) I + II
- (d) II + IV

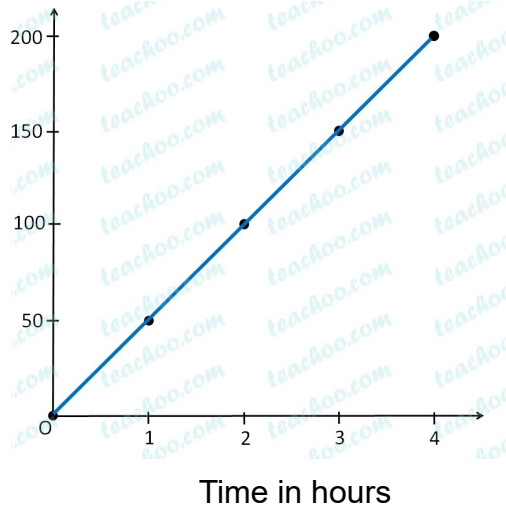
7. The area of a trapezium is given by  $\frac{1}{2} (a + b).h$  where  $a$  and  $b$  are the lengths of parallel sides of a trapezium and  $h$  is the distance between them. Find the area of the trapezium given below.





## Unit Test 15-Graphs

1. Plot the following points on a graph paper:  
(3, 4), (4, 0), (2,2), (0,6) and (2,5)
2. The graph given below presents the relation between time in hours and distance in miles covered by a car going from one city to another with a uniform speed.



- (a) How much distance the car would cover in 1 hour?
  - (b) How much distance the car had covered in 30 minutes?
  - (c) How much distance the car would cover in 6 hours?
  - (d) Would the graph differ if smaller intervals were used? If yes how?
  - (e) What is the dependent variable?
  - (f) What is the independent variable?
3. The table given below that gives the perimeter of an equilateral triangle with different lengths of sides.

Length of the side(x)	1	2	3	4
Perimeter(y)	3			

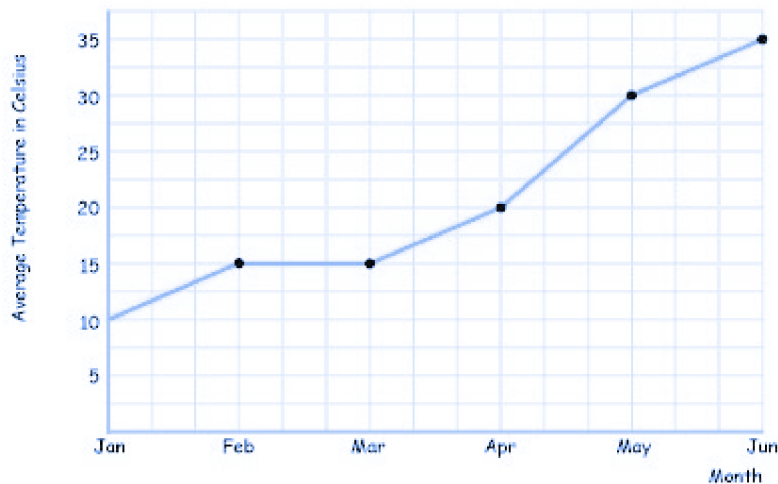
- (a) Complete the table
- (b) Draw a graph taking length along the x-axis and perimeter

along the y-axis.

- (c) What is the shape of the graph?
  - (d) What would be the perimeter of an equilateral triangle whose side is 7 cm
  - (e) If  $s$  denotes the length of the side of a triangle, what would be its perimeter?
4. The table given below that gives the perimeter of a square with different lengths of sides.

Length of the side(x)	1	2	3	4
Perimeter(y)	4			

- (a) Complete the table
  - (b) Draw a graph taking the length of a side along the x-axis and perimeter along the y-axis.
  - (c) What is the shape of the graph? What would be the perimeter of a square whose side is 7 cm?
  - (d) If  $s$  denotes the length of the side of a square, what would be its perimeter?
5. Draw a graph of simple interest that would be earned on Rs. 1000 at the rate of 10% at the end of 1, 2, and 3 years.
6. The line graph of average temperature in celsius for a city from January to June in different months is given below:
- (a) Which month was the hottest?
  - (b) What was the average temperature in the month of March?
  - (c) In which month did the average temperature rose more sharply?
  - (d) In which months the average temperature was the same?
  - (e) Do you see any trend in the average temperature?



### Project 1

- Find the price of potatoes and make a table for the price of 1, 2, 3, 4, and 5 kg.
- Write an equation that gives the cost  $y$  for  $x$  kg of potatoes.
- Draw a graph.
- Name the independent and dependent variables.
- Label the axes.
- Give a title to the graph.

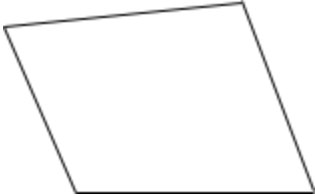
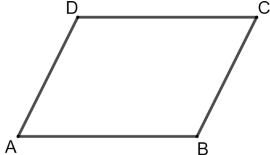
### Project 2

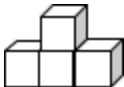
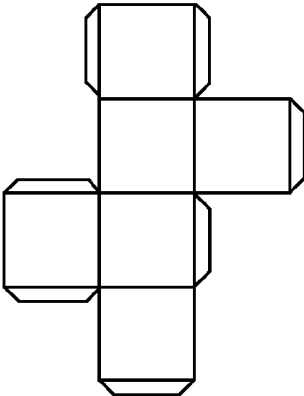
Collect data for a week on maximum and minimum temperature from a newspaper.

- Name the independent and dependent variables.
- Label the axes.
- Give a title to the graph.
- Draw a graph.
- Which day was hottest?
- Which day had the highest difference between the maximum and minimum temperatures?
- Which day had the lowest difference between the maximum and minimum temperatures?

## Criterion Test in Mathematics Class VIII

Item Number	Objective	Item
1	Knowledge	Write a rational number between $-\frac{2}{5}$ and $\frac{1}{3}$
2	Knowledge	Simplify (a) $\frac{-2}{5} \div \frac{1}{3}$ (b) $-\frac{3}{4} \times \frac{4}{9}$
3	Understanding	Fill in the blank: $\frac{6}{7} (\frac{3}{4} - \frac{5}{8}) = \underline{\hspace{1cm}} - \underline{\hspace{1cm}}$
4	Transfer	Is $(a+b)^m = a^m + b^m$ where a and b are any rational numbers and m is a whole number? If not, give a counterexample.
5	Knowledge	Find the value of (a) $\sqrt[3]{27/64}$ (b) $(.04)^{1/2}$
6	Application	Give an example of a situation in daily life where you would need to calculate the cube root of a number
7	Understanding	Ashish calculated the square root of 27.4 by calculator to be 16.55. Is his answer reasonable? If no, why?
8	Application	Rajni invested Rs. 5000 in a cumulative fixed deposit for two years with a 10% interest compounded annually. How much interest she would get at the end of two years.
9	Application	Describe a situation in daily life for which the following computations would be required. $10000 (1 + 10/100)^4$

10	Transfer	A shop gives a 10% discount for buying toys and you have to pay 7% sales tax on them. Would it make a difference in what you have to pay whether the discount is calculated first and then tax or first tax is levied and then discount given?
11	Understanding	Which of these is not an identity? Place an x against it. (a) $4a^2 + 4ab + b^2 = (2a + b)^2$ (b) $(x + a) \cdot (x + b) = x^2 + (a + b)x + ab$ (c) $(a-b)^2 = a^2 + b^2 + 2ab$ (d) $x^2 = 9$
12	Knowledge	Find the product of $(3a+2b)(9a^2+6ab+4b^2)$
13	Knowledge	Divide $x^2 + 7x + 12$ by $x + 3$
14	Application	Rahul weighs 5 kg more than Nitin. If the ratio of their weight is 8:9 Find the weight of Nitin.
15	Knowledge	Construct a quadrilateral congruent to the quadrilateral given below labeling the measures you have used. 
16	Understanding	In the parallelogram given below, $\angle A = 60^\circ$ , Find $\angle B$ 

17	Transfer	Find the sum of angles of any pentagon. (A polygon with 5 sides).
18	Understanding	<p>Some measures of sides and/or angles of a quadrilateral are given below. For each of these if a unique quadrilateral is possible, construct it. If not, write A If the information is not sufficient to construct a unique quadrilateral and B If it is not possible to construct a quadrilateral with these measures.</p> <p>(a) <math>AB = 4\text{ cm}</math>, <math>BC = 7\text{ cm}</math>, <math>AD = 3\text{ cm}</math>, <math>CD = 6\text{ cm}</math></p> <p>(b) <math>AB = 3.6\text{ cm}</math>, <math>BC = 5.5\text{ cm}</math>, <math>CD = 5\text{ cm}</math>, <math>\angle B = 83^\circ</math>, and <math>\angle C = 80^\circ</math>.</p>
19	Understanding	<p>Draw the top and side view of structure given below:</p> 
20	Application	Give directions for going to the library of your school from the gate of your school.
21	Understanding	<p>Name the solid that we can make by folding the net given below and give its properties:</p> 

22	Knowledge	Find the area of the figure given below										
23	Understanding	Draw a rhombus whose area is 6cm. Indicate the measures used to draw it										
24	Application	Give situations in daily life in which you need to estimate the surface area of a cuboid.										
25	Transfer	How can a contractor estimate how many truckloads of earth would be needed to raise the level of certain length of a road by 15 centimetres.										
26	Knowledge	<p>The percentage of students getting different grades in mathematics in a class were as follows; A-20%, B-40%, C-30%, D-5% and F-5%</p> <p>Draw a pie chart showing the grades students in the class.</p>										
27	Understanding	If you throw a dice, what is the probability of an odd number showing up?										
28	Application	Give a situation in which you would like to present your data by a histogram										
29	Knowledge	Plot (0,7) on a graph paper										
30	Application	<p>The perimeters of equilateral triangles, whose sides vary in length are given below:</p> <table><tr><td>Length of the side</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>Perimeter</td><td>3</td><td>6</td><td>9</td><td>12</td></tr></table> <p>Draw a graph of the data</p>	Length of the side	1	2	3	4	Perimeter	3	6	9	12
Length of the side	1	2	3	4								
Perimeter	3	6	9	12								
31	Application	A shop is giving a 20% discount. How much would you have to pay for a shirt marked Rs.150?										

32	Understanding	A fruit seller bought 25 kg of bananas at Rs.20 per kg. At how much per kg he should sell to make a profit of 10%?
33	Transfer	A shop gives a 10% discount for buying toys and you have to pay 7% sales tax on them. Would it make a difference in what you have to pay whether discount is calculated first and then tax or first tax is levied and then discount given?
34	Application	Describe a situation in daily life for which the following computations would be required. $10000 (1 + 10/100)^3$
35	Application	Which of the following variables vary inversely? A The speed of a car and time taken to cover a certain distance. B The speed of a car and distance covered in a fixed time. C Amount of fixed deposit in a bank and interest earned on it.
36	Application	If 12 labourers can dig a Road in 4 days. How many labourers should be employed to finish it in 3 days?